ENGINEERING AND MINING JOURNAL

October, 1946

Loading iron ore in a mine in the Birmingham District

Fusion-Piercing for Blast Holes in Hard Ground —Page 63

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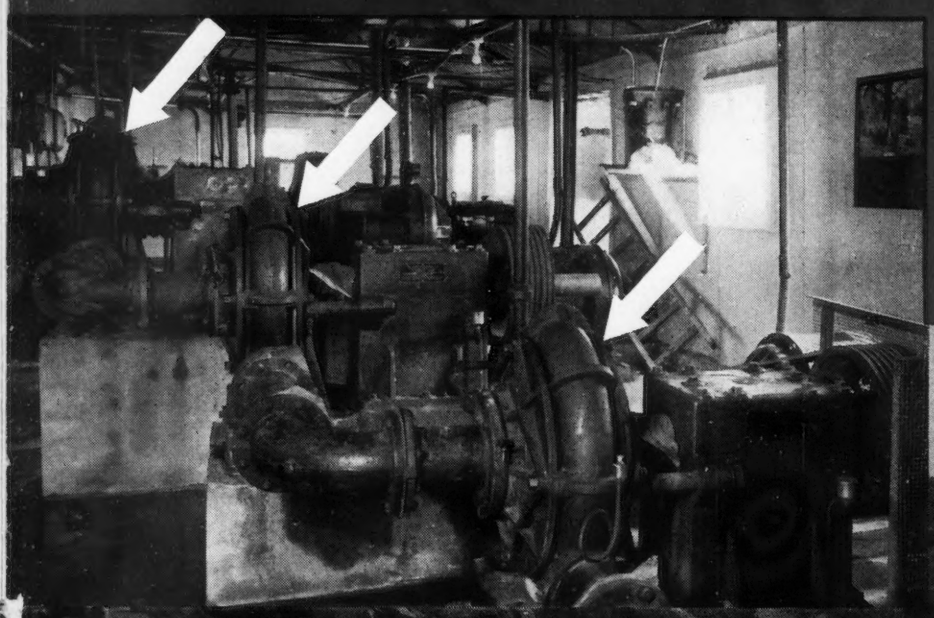

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Three C-Frame Hydroseal Pumps in series, pumping to washer, which is out of picture

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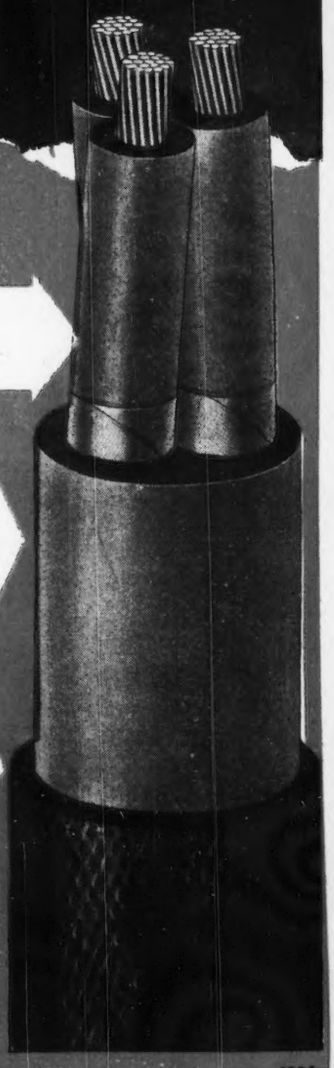

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OCTOBER, 1946

Fusion-Piercing Makes Its Bow

FUSION-PIERCING, the process for making blast holes which is announced on page 63, is something radically new in mining practice. As is usual with meritorious new processes and equipment, it has been undergoing development quietly for several years by the company that controls it. The announcement, brief as it is, will stimulate the thought of mining men and doubtless will open to some a vista of hitherto unthought-of possibilities.

In talking of fusion-piercing, as he is bound to do, the mining man should note that the name adopted for the process omits all reference to drilling. This is not accidental. Let him bear in mind from the outset that fusion-piercing is not "drilling," that blast holes thus made are not "drilled." Using the high heat derived from the combustion of oxygen, and with the addition of fluxing material, fusion-piercing actually smelts a hole rapidly into the ground, the molten material being forced upward as it is produced and by the action of the steam separated into fairly large particles. At the same time, fusion-piercing is not expected to supplant drilling, so far as any one can see, save possibly in putting down blast holes from surface where the ground is so hard that a cutting or reaming tool can advance but slowly.

Thus applied, as is being done today, fusion-piercing may offer a solution for the problem of breaking taconite, the extremely hard, low-grade iron formation of the Mesabi and other Lake Superior ranges, on which many appear to be counting for a future supply of iron ore.

Now that this new way of making holes has been formally introduced, the industry will watch its progress hopefully. Every such departure from a standard, time-hallowed way of doing things is fresh evidence that mining practice, which years ago seemed almost static, is instead dynamic and moving ahead. Mining practice must indeed move ahead if mining costs are to be cut progressively, to meet the steadily increasing expenditures that are necessary for wages and supplies.

Opportunity for Industry-Government Cooperation

AT THE recent excellent and informative meeting of the American Mining Congress in Denver, the new Secretary of the Interior made a speech that we hope will launch a new era of better, more constructive relations between the mining industry and Government, and enable both to serve the public more effectively.

Secretary Krug starts with a substantial handicap inherited from his predecessor. The distrust and discord built up by "Curmudgeon" Ickes and his opportunistic and socialistic cohorts will not disappear over night. Nevertheless, "Cap" Krug made a tremendous stride toward wiping out distrust and inherited grudges by the sound common sense he enunciated, by his straightforward espousal of maximum private enterprise, and by his willingness to cooperate with the mining industry. The industry will make a serious mistake if it fails to act with the utmost vigor and sincerity upon his request for an advisory committee.

The personnel of this committee should be willing to work, representative of the widespread and diverse elements of the industry, large and small, and dedicated to solutions that will align industry interests and realism with sound national policy. If we fail to fulfill these objectives then at some time in the future it can be truly said that we failed to meet Secretary Krug halfway in his splendid offer of cooperation.

Mr. Krug stated in the most unequivocal terms his desire to reinforce democratic methods and private enterprise, and to make the Interior Department's activities supplementary to the mining industry rather than competitive with it. He called for healthy, "going," domestic mining industries as a necessary backlog to stockpiling as a means of safeguarding national security. Nevertheless, he did not hesitate to point out that we have serious mineral reserve problems, and that the "Buy American" principle can be overworked by encouraging production from relatively scarce domestic reserves beyond the degree necessary to

foster progressive technology and "going" industries (page 125).

The same cooperative and constructive attitude manifest in Secretary Krug's address was also embraced in Director Wrather's statement on the aims of the U. S. Geological Survey.

In our opinion, the stage is now set for a golden era of constructive cooperation between the mining industry and Government. To supplement the industry effectively and to appraise and foster development of our marginal resources, leaves the gate wide open for the Survey and Bureau of Mines to work and expand to an extent limited only by their own capabilities. In short, no interested party has any logical basis for failing to extend full cooperation.

However, in this auspicious outlook there is one conspicuous flaw, which, if not eliminated, is likely to promote disharmony. The mining industry is smothered with taxes which stifle initiative by making the risks of new enterprise illogical; also, the industry is handicapped and resentful over tax administration policies which disregard common decency and circumvent the will of Congress by using every possible device, however inconsistent, to gouge every last dollar out of the taxpayers. Members of the industry are bound to regard the expenditure of large sums for research and development by Government agencies critically when they feel that taxes prevent the industry from doing a good job on its own account. The fact that the Interior Department has no hand in shaping Treasury policies is not likely to make any change in this attitude.

Because the special features of mining economy are poorly understood in Washington, the industry badly needs a champion on the Cabinet level to aid in reconciling Government policies and to enable the industry to carry on its economic functions efficiently. These objectives are entirely consistent with sound public policy. Therefore, we earnestly urge Secretary Krug to become such a champion. This course would be in line with his duties as custodian of the nation's interest in its resources, and would forestall continued discord between his department and the mining industry.

Ontario Sets an Example

AFTER STUDYING THE REPORT on the rope failure at the Paymaster Consolidated Mines, Ltd., and subsequent investigation of hoisting practices in general, which was prepared for the Ontario Department of Mines through the joint efforts of a government-appointed committee of faculty members of the University of Toronto, and an industry committee of the Ontario Mining Association, we cannot restrain an expression of admiration for the fine work performed by these cooperating groups.

In a determined effort "to get to the bottom" of causes of shaft accidents and prevent their occurrence, members of the committee made an exhaustive study of technical literature from many parts of the world—147 references are listed in the bibliography. Case histories of 33 accidents involving the fall of mine cages were studied with particular attention to the performance of safety dogs. Likewise, the primary causes and points of break of 47 recorded rope failures were analyzed.

Industry's all-out support is evinced by the fact that 48 mining companies in the Province conducted and recorded 116 tests in which cages were actually dropped to determine the effectiveness of various safety devices under different loads and conditions. Thirty-one types of safety dogs are illustrated in the report, some of which embody original ideas not generally adopted. Every designer of shaft equipment should familiarize himself with the 21 desirable characteristics of cage safety devices which the committee approved.

Much useful and thought-provoking information is included in the section of the report which deals with rope corrosion and deterioration. It is noted, for example, that pure water in the presence of oxygen can cause corrosion as well as acid water or salts in solution. Evidence is cited which suggests that the primary function of rope lubricants is to prevent corrosion rather than to lubricate. Regarding the use of electromagnetic devices to detect rope deterioration by external methods, the report states, "Fortunately rope corrosion, which is the most difficult to detect physically, seems to show up clearly in magnetic tests," and concludes that "sufficient promise exists in the results of the various electromagnetic investigations that have been conducted to justify continuation and extension of these tests." We suggest that mechanical and electrical departments of mines in all countries would do well to investigate and experiment with these new supplementary devices for rope inspection. Continued effort and ingenuity will be required to solve the internal corrosion problem completely.

The report closes with 25 constructive conclusions and recommendations pertaining to safe hoisting installations and practices submitted by the Ontario Mining Association Committee, and 53 by the government-appointed committee.

Unquestionably, this pattern of accomplishment through cooperation of industry, government, and technical institutions deserves wider adoption in other mining areas.

Bigness Is a Crime

A RECENT DECISION of the United States Supreme Court qualifying the "crime of monopolization" is of interest to mining and any other industry in which large organizations are conspicuous, because the judicial fraternity seems to be moving rapidly in the direction of declaring all bigness to be bad merely by virtue of size. If this trend continues, the domestic mining industry may have to do without some of the aggregations of plant and capital which have lent themselves to certain gains in efficiency. The demise of these units may leave the Government as the only instrument able to undertake the research, risk, and investment on a grand scale necessary to find and develop hidden ore reserves and develop low-grade deposits.

The decision under discussion was handed down in June against the "Big Three" in tobacco, who had been convicted in district and circuit appeal courts of conspiracy in restraint of trade, monopolization, and conspiracy to monopolize. The Supreme Court took the case, not because it entertained any doubt of the defendants' guilt, but to affirm that "neither proof of exertion of the power to exclude nor proof of actual exclusion of existing or potential competitors is essential to sustain a charge of monopolization under the Sherman Act." In other words, the Court wanted to show that the mere possession of latent power to dominate a market is a crime, even though the power lies unused.

In establishing this viewpoint, the Court was clearly embarrassed by two qualifications in the statements of the district court: first that "an indispensable ingredient of each of the offenses charged . . . is a combination or conspiracy," and second that "it is in no respect a violation of the law that a number of individuals or corporations, each acting for himself or itself, may own or control a large part, or even all of a particular commodity, or all the business of a particular commodity."

On the first qualification cited, the Supreme Court stated "the question before us . . . makes no express reference to the . . . element of a 'combination or conspiracy' . . ." The second qualification was contradicted by inference in the first quotation given above and by the following excerpts:

"The authorities support the view that the material consideration in determining whether a monopoly exists is not that prices are raised and that competition actually is excluded but that power exists to raise prices or to exclude competition when it is desired to do so. . . .

"It is not necessary that the power thus obtained should be exercised. Its existence is sufficient."

The Court also endorsed the following statements which had been made by the circuit court in the Alcoa case:

"It (Alcoa) may not have achieved monopoly; monopoly may have been thrust upon it.

". . . so far as concerns the public interest, it can make no difference whether an existing competition is put an end to, or whether prospective competition is prevented. . . .

"It insists that it never excluded competitors; but we can think of no more effective exclusion than progressively to embrace each new opportunity as it opened, and to face every newcomer with new capacity already geared into a great organization, having the advantage of experience, trade connections and the elite of personnel."

The Supreme Court also made the following interesting observations: "Such advertising may benefit indirectly the entire industry, including the competitors of the advertisers. Such tremendous advertising, however, is also a widely published warning that these companies possess and know how to use a powerful offensive and defensive weapon against new competition. New competition dare not enter such a field, unless it be well supported by comparable national advertising."

It seems, in our opinion, that it is already established as a crime to be big and reasonably efficient. If a conspiracy is unnecessary to the crime of monopolization, and the latent power to restrain trade is adequate to convict, even though the victims may not have exercised such power or had any intent to do so, then a company, or limited number of companies, which merely by size enjoys the bulk of a market is inevitably guilty! When as evidence of guilt are adduced extensive advertising, progressiveness, reserve capacity, and the employment of high-grade personnel, then it appears that the only way large companies can escape conviction is to be inefficient!

We repeat again that it is time for a Congressional overhaul of anti-trust legislation. We do not believe that either Congress or the people ever intended to have the Sherman Act used to annihilate big business or to deprive our nation of the industrial strength and efficiency to which bigness has contributed in many ways. The mere fact that Congress and the people seek to give special encouragement to small business does not mean that they would destroy large units that are operated cleanly, or are so effective in providing better goods at lower prices that their efficiency discourages competition.

Making Tin Flotation Work—No. 1, Canutillos Ore

A. M. GAUDIN, R. SCHUHMANN, JR., and E. G. BROWN, Richards Ore Dressing Laboratory, Massachusetts Institute of Technology, Cambridge, Mass.

Successful flotation methods for Bolivian tin ores have been sought by many investigators ever since the ore came into general use. The reason, of course, is that current gravity separation of cassiterite fails to recover more than perhaps an average of 50 percent of the tin mined in Bolivia. We feel privileged, therefore, to offer herewith a series of four articles by Professor Gaudin and his coworkers in which they report on successful attempts to concentrate Bolivian tin ores by flotation. Not only have practicable tin-recovery methods been worked out, but substantial contribution has been made to the search for a really selective non-sulphide flotation method. The initial article follows; the three others will appear in succeeding issues.

The Editors.

Loss of the Malayan and Dutch East Indies tin production early in the war made it imperative to the Allies that all possible measures be taken to increase tin production in Bolivia. One of the likeliest possibilities lay in improving methods of concentration, for it was apparent that processes observed by one of the authors during a visit to Bolivia in 1942 were yielding very low recoveries. In addition, large tonnages of potential tin ore lay untouched for lack of an applicable treatment method, and accumulated mill tailings also offered a yield of tin if a feasible process could be devised.

Developments in non-sulphide flotation over the past decade indicated that these tin ores might now be successfully floated. A laboratory investigation of flotation of Bolivian tin ores was therefore begun in July 1942 and carried on until March 1945. The results are presented in these four articles.

The study of the Canutillos ore, described in this first article, was undertaken for the account of the Bolivian Tin & Tungsten Corporation, and more particularly for Sr. Simon Patiño, president of Patiño Mines & Enterprises Consolidated. Essentially, the process suggested here includes fine grinding, iron leaching, and flotation using oleic acid as collector and soda ash, tartaric acid, and sodium silicate as modifiers. On an ore assaying 2.85 percent tin and 15 percent iron, this process recovers 85 percent of the tin in a concentrate assaying 55 percent tin.

Present Methods

The Canutillos mine is in the Colavi district about 60 km. northeast of Potosi,[a] at an altitude of about 14,000 ft. In 1942, when the mine was visited by one of the authors, the flat-lying deposit was opened by a network of tunnels laid out roughly at right angles to one another. The ore was hand-sorted to yield a product assaying about 30 percent Sn, but little tin was recovered thereby. Waste from this operation fed a mill, where the ore was ground in a ball mill and then passed over shaking tables and buddles. The concentrate assayed about 30 percent Sn, with a recovery of about 30 to 35 percent of the tin from 4 percent ore.

A shipment of 50 tons of mine-run ore was received at Cambridge, Mass., and one-sixteenth was cut by standard sampling procedures for use in the laboratory work. Analytical data for head samples are given in Table I. It is clear from these data that the ore is highly

Patino's present mill and colony at Catavi on the Bolivian *altiplano*.

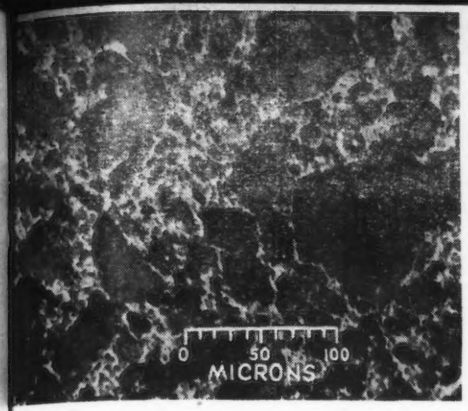


Fig. 1. Common structure of Canutillos ore is coarse quartz grains (dark) in matrix of goethite (light gray) and fine quartz, as shown in this polished section.

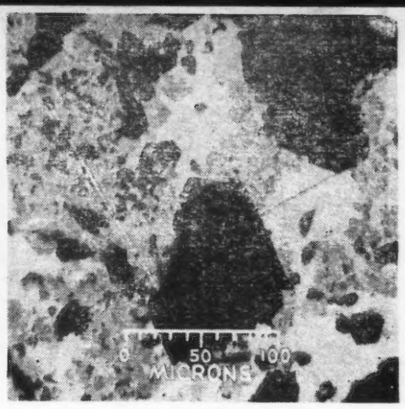


Fig. 2. More favorable, but not typical, occurrence of tin is in cassiterite grains (gray) between 10 and 30 microns in size with quartz (black) in goethite (light).

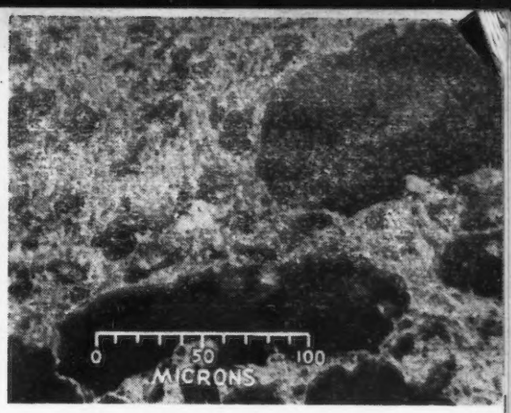


Fig. 3. Unfavorable and widespread occurrence of tin in an intimate mixture of cassiterite, goethite, and quartz. Large quartz grains are about 150 mesh.

siliceous and that iron minerals must account for the bulk of the non-silica waste.

Mineralogy

Quartz and goethite make up the bulk of the weight of Canutillos ore. The common structure (see Fig. 1) is of quartz crystals approximately 50 to 100 microns in size in a matrix of goethite generally peppered with fine quartz fragments.

The tin is in the form of cassiterite, rather unevenly distributed in the matrix material. One such structure is shown in Fig. 2, wherein no cassiterite crystal exceeds 30 microns in size and many are 5 to 10 microns in size. Some clusters of cassiterite crystals with inclusions of goethite and of quartz, however, measure up to 100 or 150 microns. From an ore-dressing standpoint, this structure represents the most favorable occurrence of the cassiterite, but it is not typical. Fig. 3 shows two quartz grains of about 150-mesh size in a matrix of intimately mixed goethite, cassiterite, and fine quartz, a structure that is unfortunately relatively widespread.

The foregoing facts gave rise to some doubt that the tin could be concentrated satisfactorily by a procedure of mechanical severance followed by flotation. Accordingly, it appeared desirable to determine more quantitatively the extent to which the cassiterite was liberated from the gangue minerals by ordinary grinding. This problem was studied as follows: A representative sample of the ore was ground in the laboratory pebble mill to 99.7 percent minus-65 mesh and 65 percent minus-200 mesh. The ground ore was then separated by screening and by sedimentation to obtain a series of size grades ranging from 11 microns to 208 microns

Table I. Canutillos Ore — Head Sample Analysis

Element	Percent
Tin	2.82
Iron	15.3
Silica	64.9
Alumina	4.2
Titania	0.77
Ignition loss	5.0

(65 mesh). Each size grade was fractionated by sink-float separation in tetrabromoethane and by magnetic separation with the Frantz Isodynamic magnetic separator [1] into a series of six fractions. This procedure sorted out the different species of particles and made it possible to apply the statistical methods of quantitative mineragraphy[3] to obtain an estimate of the cassiterite liberation. The nature of the fractionation can be shown by reference to the ternary diagram in Fig. 4.

The fractions into which the ore was divided are represented approximately by the five areas on the diagram, labelled I, II and III, IV, V and VI, respectively. The sized material was first separated according to specific gravity in tetrabromoethane. This gave Fraction I as the float product (sp.g. less than 2.95), leaving the remaining fractions together in the sink (sp.g. greater than 2.95). This sink product was washed and dried and then fractionated in the Frantz magnetic separator to obtain products II, III, IV, V, and VI, of successively lower magnetic susceptibility. Since quartz and cassiterite are non-magnetic, the magnetic fractionation is primarily a grading according to iron content.

Table II gives a composite summary of the fractionation for all the sizes of the 65-mesh grind except the finest or slime fraction (minus 11 microns). Perfect liberation of cassiterite would mean that all the tin would report in Fraction VI. Actually, only 42.7 percent of the tin was found in this fraction. Furthermore, the microscope study showed that even this percentage figure presents an optimistic view of the cassiterite liberation. That is, it was found that a substantial proportion of the cassiterite particles in Fraction VI were lightly iron-stained or were covered with irregular, patchy coatings of goethite (see Fig. 5), removable by a quick acid leach.

The high-tin middling fractions (V) account for almost one quarter of the tin. These particles show little cassiterite on the outside (Fig. 6) and thus from a flotation standpoint would behave in the same way as goethite particles devoid of tin. The tin contents of the

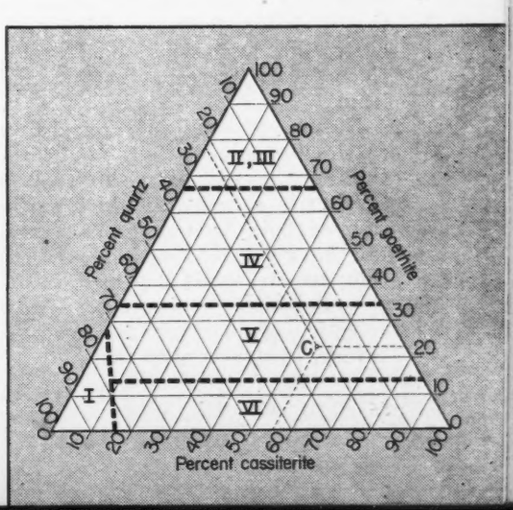


Fig. 4. This diagram aided in quantitative study of degree of liberation of cassiterite to be expected in grinding Canutillos ore. Point C, for example, represents a particle composed of 55 percent cassiterite, 23 percent goethite, and 22 percent quartz. Free particles are represented by the corners; binary particles fall along the edges. The five numbered areas show the ore fractions produced as described in the text.

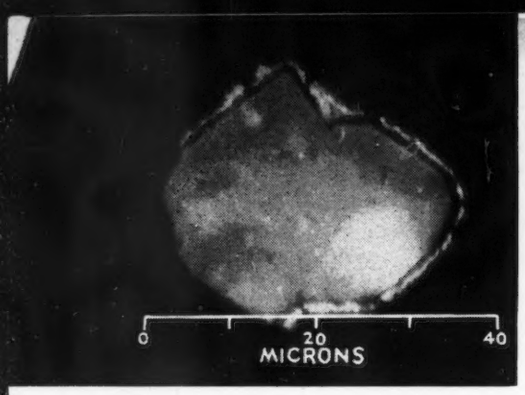


Fig. 5. Cassiterite particle (gray) from Fraction VI (Fig. 4), showing thin goethite coating (light gray). In general, a quick acid leach bleached particles such as this one, indicating a surface iron stain.

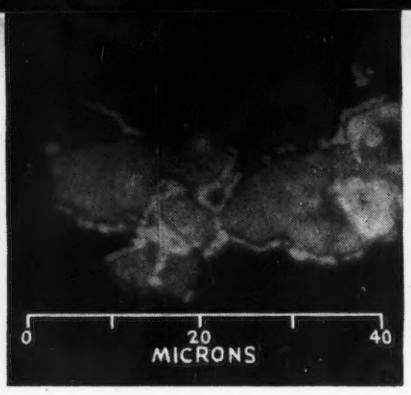


Fig. 6. Tin middling particle from Fraction V shows cassiterite (dark gray) surrounded by goethite (light gray). Flotation behavior of these would resemble goethite and cause loss of tin.

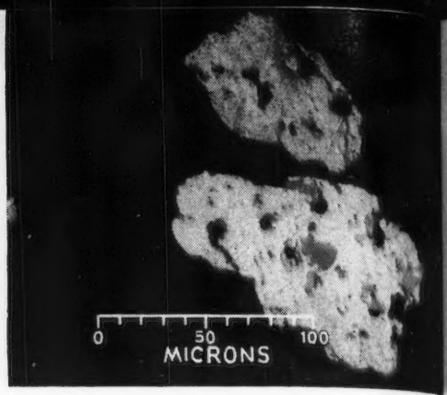


Fig. 7. Locked particles from Fraction III show goethite (light gray) peppered with cassiterite (gray) inclusions 5 to 20 microns across. For particles as hopelessly locked as these, only chemical dissolution will serve.

high-iron fractions III and IV are even more hopelessly locked. (Fig. 7).

Referring again to Table II, it is seen that just over 70 percent of the weight reported in the quartz Fraction I and that this fraction is relatively low in both tin and iron. Petrographic examination showed that many of the quartz particles had light, patchy ferruginous coatings which might make sharp flotation separation difficult, especially in the coarser sizes of the 65-mesh grind. In general, however, it appeared that fair liberation of the quartz was attainable by fine grinding to minus-200 mesh.

On the basis of the foregoing, grinding for liberation of quartz followed by flotation of a bulk tin-iron concentrate appeared to be logical primary steps. A 95 percent minus-325-mesh grind was thought to be about optimum. Allowing a little leeway for difficulty in floating the extreme fines, the best results that can be anticipated on structural grounds in making a bulk tin-iron concentrate would be about as follows: 90 percent recovery of tin in a concentrate assaying 10 percent tin and 37 to 38 percent iron, with tailings assaying about 0.4 percent tin. Considerable difficulty may be experienced in approaching these results, owing to the probable tendency of lightly coated quartz to float under conditions favoring recovery of tin and iron.

Nature of the quartz-goethite-cassiterite associations indicates that production of a high-grade cassiterite concentrate, with rejection of both iron and silica, and fair to good recovery, is structurally remote, while that of a cassiterite-goethite concentrate, with rejection of quartz, and a good recovery, is structurally feasible.

Direct Flotation Tests

Most of the flotation tests made were based on oleic acid as a collector. However, a number of other collectors were also tested. These included: saturated long-chained fatty acids (e.g., the C16 and C18 acids); short-chained fatty acids; catonic collectors such as lauryl pyridinium iodide and lauryl amine; sulphated fatty alcohols (e.g., gardinol). None of these collectors appeared to have advantages over oleic acid.

Modifying agents tested with oleic acid include: alkaline agents such as sodium hydroxide, sodium carbonate, sodium bicarbonate, sodium sulphide, sodium hydrosulphide; cation-complexing agents such as Calgon (sodium hexametaphosphate), sodium pyrophosphate, sodium cyanide, Daxad No. 23 (sodium lignin sulphonate), tartaric acid, citric acid, hydrocarbon oils such as fuel oil, Nujol, kerosene; metal salts such as those of copper, tin, lead, iron, barium, calcium, magnesium; acids such as sulphuric, hydrochloric, acetic; oxidizing and reducing agents such as hydrogen peroxide and hydroxylamine hydrochloride.

Broadly speaking, the experiments indicated that the following conditions give the best results in floating the Canutillos ore with oleic acid: a pH between 6.75 and 7.10 must be maintained; tartaric acid, sodium carbonate, and sodium silicate are helpful, especially together; all other modifying agents tried are either deleterious or wasted.

In a representative test (No. 194 in Table IV) a charge of 1.0 kg. of minus-20-mesh ore was ground for 31 minutes in a one-gallon porcelain mill with 9.0 kg. steel balls and 500 cc. water at 64 rpm, using as reagents added to the grind: tartaric acid 2.0 lb. per ton, sodium silicate 2.0 lb. per ton, sodium carbonate 3.0 lb. per ton. Screen analysis of the ground pulp is given in Table III. In the flotation cell (a stainless steel, 1,000-gram Fagergren cell) were added 1.06 lb. oleic acid and 0.20 lb. tartaric acid per ton of ore. The resulting pH was 6.90. The pulp was conditioned 30 minutes with the air turned off and then floated.

The rougher float was dewatered, reground in the same mill for 12 minutes, and then refloated. Tartaric acid 1.0 lb., sodium silicate 1.0 lb. and sodium carbonate 1.5 lb. per ton of ore were added during the grind, and tartaric acid 2.5 lb., sodium silicate 0.93 lb., and oleic acid 0.27 lb. per ton of ore were added during cleaning. The pH in the cleaner was 7.0. The metallurgical results of this test (Table IV) show some selection as between tin and iron in the roughing operation and more selection in the same direction in the cleaning operation, but they are disappointing in respect to the possibility of making a useful tin-iron separation.

A summary of the metallurgical results by direct flotation was prepared in the form of a chart correlating recovery with grade of concentrate for about 250 flotation tests. The result was a well-delineated maximal line relating grade to recovery. This line passed approximately through the following coordinates:

Grade, Percent Sn	Recovery, Percent Sn
2.85	100
5.0	96
7.5	90
10.0	84
15.0	72
20	60
30	45

Typical Test Data on Suggested Leach-Float Process for Canutillos Ore

Table II. Data for Fractionation of a Minus-65-mesh Grind

Fraction Number	Weight, Percent	Tin		Iron	
		Assay, Percent	Percent of Total	Assay, Percent	Percent of Total
I	71.9	0.35	9.0	2.73	15.3
II	1.8	0.65	0.4	53.5	7.5
III	14.1	1.44	7.2	49.6	54.8
IV	7.6	6.29	17.0	32.8	19.5
V	2.0	33.2	23.7	14.1	2.2
VI	2.6	46.0	42.7	3.42	0.7
Totals	100.0	2.81	100.0	12.8	100.0

Table III. Screen Analysis of 31-minute Grind

Screen Size	Weight, Percent	Cumulative Weight Coarser, Percent
+100 mesh	0.02	0.02
−100 mesh +200 mesh	2.89	2.91
−200 mesh +400 mesh	24.77	27.68
−400 mesh	72.32	
Total	100.00	

Table IV. Metallurgical Result — Flotation Test No. 194

Product	Weight, Percent	Tin		Iron	
		Assay, Percent	Distribution, Percent	Assay, Percent	Distribution, Percent
Cleaner concentrate	5.7	22.0	44.6	30.0	10.7
Cleaner tailing	18.0	5.72	36.7	34.4	38.7
Rougher concentrate (calc.)	(23.7)	(9.64)	(81.3)	(33.3)	(49.4)
Rougher tailing	76.3	0.69	18.7	10.6	50.6
Feed (calc.)	100.0	(2.81)	100.0	(16.0)	100.0

Table V. Leaching Data, Test 540

Time	Total Iron in Solution, Grams, per Liter	Percent of Iron Dissolved	Total Sulphate in Solution, as Grams H_2SO_4 per Liter*
0	0	0	
10 min.	4.9	8	113
6 hrs. 00 min.	49.8	80	160
11 hrs. 40 min.	57.8	93	173
21 hrs. 30 min.	60.1	97	186
22 hrs. 30 min.	60.7	98	186

* Determined gravimetrically by precipitating as barium sulphate.

Table VI. Sulphuric Acid Manufacture, Test 547

Time	Total Iron in Solution, Grams per Liter	Total Sulphate in Solution, Grams H_2SO_4 per Liter
0	5.2	19.4
1 hr.	5.2	24.2
3 hrs.	5.2	29.2
19 hrs.	5.2	68
42 hrs.	5.2	123
67 hrs.	5.2	154

Table VII. Results of Pre-flotation, Leaching, and Re-treatment Flotation

	Weight, Percent	Tin Assay, Percent	Tin Distribution, Percent
Re-treatment cleaner concentrate	5.0	45.3	78.8
Re-treatment cleaner tailings	2.4	6.59	5.5
Re-treatment rougher tailing	24.0	1.03	8.7
Loss in leach liquor	19.9*		0.5*
Pre-flotation tailings	48.7	0.38	6.5
Feed	100.0	2.85	100.0

* These figures were obtained by difference, and therefore may reflect losses in handling and small assaying errors.

Table VIII. Results of Leaching Followed by Flotation

	Weight, Percent	Tin Assay, Percent	Tin Distribution, Percent
Test No. 342 (1 kg. feed)			
Recleaner concentrate	3.8	56.4	85.5
Recleaner tailing	0.7	9.26	2.7
Cleaner tailing	4.4	2.06	3.6
Rougher tailing	63.0	0.33	8.2
Loss in leach liquor	28.1		0.0*
Calculated feed	100.0	2.53	100.0
Test No. 366–67 (12 kg. feed)			
Recleaner concentrate	4.2	54.8	86.4
Recleaner tailing	1.0	9.90	3.6
Cleaner tailing	2.5	2.64	2.5
Rougher tailing	63.1	0.32	7.5
Loss in leach liquor	29.2		0.0*
Calculated feed	100.0	2.68	100.0

* Assumed.

In addition to the oleic acid floats, some encouraging results were obtained in making a preliminary float with oleic acid, as already described, followed by re-treatment with a catonic agent such as lauryl amine hydrocloride, which gave a final tin float and an iron sink. In a typical test, for instance, the final concentrate contained 30 percent tin and 18 percent iron and the high-iron reject contained about 5 percent tin and 46 percent iron.

In spite of the somewhat encouraging possibilities of this re-treatment procedure, the verdict of structural difficulty was so adverse that it was decided to explore the possibilities of processes involving leaching the iron.

Leaching the Iron*

Freshly precipitated ferric hydroxide is soluble in almost any dilute acid, but the same is not true of the mineral goethite FeO(OH), which requires relatively strong and preferably reducing acids, nor of the oxides magnetite and hematite, which are relatively insoluble in acids, even in analytical procedures. The porous, high-surface character of the Canutillos goethite gave hope that it could be

* The experimental work on leaching away the iron was carried out within the project by Eugene F. Poncelet, now research engineer, Preston Laboratories, Butler, Pa.

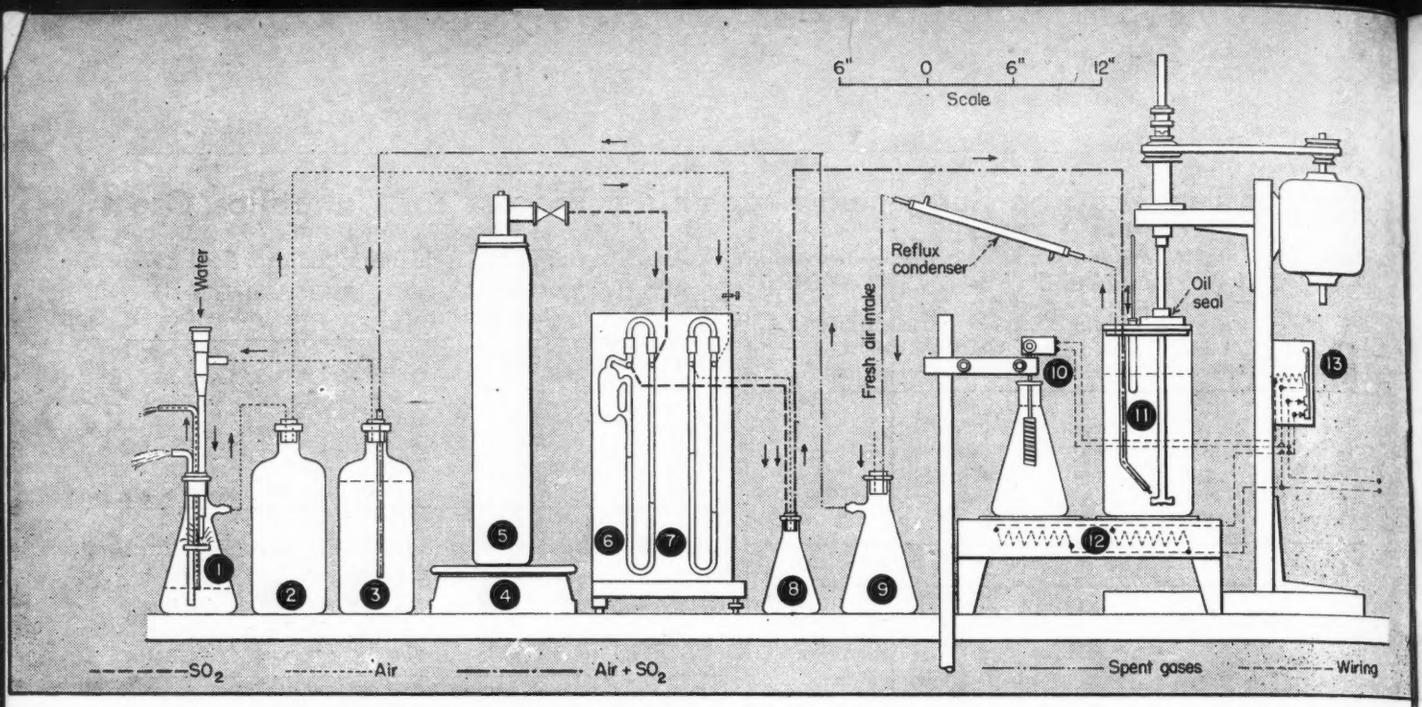


Fig. 8. Leaching apparatus for SO_2 dissolution of Canutillos goethite included: Pyrex glass leaching jar (11), with glass impeller passing through oil seal and ground-glass lid; constant temperature arrangement of thermoregulator (10), hot plate (12), and relay (13); flowmeters (6) and (7) calibrated for SO_2 and air respectively; SO_2 cylinder (5) on a balance (4); hydraulic compressor and gas washer (1). SO_2 and air go through gas mixer (8) into leach jar; spent gases leave jar through reflux condenser and gas collector (9), where fresh air enters the line to prevent build-up of nitrogen in system. Excess of air drawn in here leaves again through pressure-regulating device on compressor. Pressure in jar approximates atmospheric. Exit gases continue through SO_2 absorber (3) and re-enter compressor, which returns air at constant pressure through receiver (2).

dissolved in acid. This was verified on a laboratory scale, first with hydrocloric acid and then with mixtures of sulphur dioxide, sulphuric acid, and common salt. Details of the apparatus are given in Fig. 8.

Experiments were made with both ore and flotation concentrates using either pure SO_2 or mixtures of SO_2 and air. The iron dissolution rates were not satisfactory until salt and sulphuric acid were present in the pulp liquor.

The Leaching Procedure

The following test (No. 540) illustrates the leaching procedure developed: A pulp was made of 700 grams of flotation concentrate (assaying 6.95 percent tin, 28.8 percent iron, recovery 91.7 percent), 300 grams of salt, 200 c.c. of concentrated sulphuric acid, and water to a total pulp volume of 3,350 c.c. Temperature was maintained at 80 deg. C., SO_2 being fed at the rate of 28 grams per hour and air at 93 grams per hour. Leaching period was 22.5 hours, after which time the pulp was filtered, washed, dried, weighed, and sampled. The residue assayed 0.84 percent iron, 13.7 percent tin, the iron extraction being 98.4 percent. Leaching data are given in Table V. Iron dissolves rather rapidly in the first few hours, but extended treatment is necessary to obtain a high extraction of iron.

Table V shows that the amount of sulphate made from SO_2 during leaching is less than equivalent to the amount of iron dissolved, even if the iron were calculated as ferrous sulphate. In other words, the leaching operation actually consumed both SO_2 and sulphuric acid. However, the process can be made self-sufficient with respect to sulphuric acid by an added step, which may be called the acid-production step. This consists of passing SO_2 and air through ferric sulphate solutions, a procedure studied by the Bureau of Mines years ago.[5]

The acid-production step was tested as follows: The leaching jar in Fig. 9 was charged with 3,350 c.c. of a mixture of about 10 percent high-iron waste liquor (produced by leaching procedure already described) and 90 percent fresh water. This mixture was treated at 45 deg. C. with 28 grams SO_2 per hour and 93 grams air per hour, with results shown in Table VI. These data show that sulphuric acid in the concentration necessary for leaching is readily produced. However, calculations from these data indicate a SO_2 efficiency of only about 16 percent. Comparison with data reported by Ralston and coworkers[5] giving SO_2 efficiencies in many cases over 80 percent for similar experiments, shows that our apparatus and operating conditions can be improved.

Raw materials for the proposed leaching process are pyrite and salt, both of which are available in large quantities in Bolivia. Preliminary calculations of leaching costs on the basis of prices and conditions at the proposed plant site, and assuming an over-all SO_2 efficiency of 75 percent (including the SO_2 used in the leaching step), indicate the scheme to be feasible.

Floating Leached Ore

Flotation of the leached ore is much more satisfactory in all respects than that of the raw ore. The only precaution is that the leach residue must be washed until substantially free of dissolved iron.

The higher grade of concentrate obtained by floating after leaching is attributable in large measure to the elimination of goethite, which generally represented more than one-half of the weight of the concentrate obtained from unleached ore. Leaching also improved both grade and recovery by freeing quartz and cassiterite from various kinds of locked particles, especially locked quartz-goethite particles and ternary particles consisting of grains of quartz and cassiterite held together by a ferruginous

cement. That is, the leaching step provides chemical severance in addition to the mechanical severance obtained by grinding.

The much lowered consumption of flotation reagents after leaching was unexpected. It may be well to point out, also, that the whole flotation operation is mechanically much better and more rapid, and that the tolerances in operation are wider.

Some Tests

The following tests are presented as examples, one in which the ore was first floated, then leached with SO_2, then refloated and cleaned (No. 347-A); and the others in which the ore was first leached with hydrochloric acid, then floated, cleaned, and recleaned (No. 342 and No. 366-67).

Pre-flotation, leaching, and re-treatment flotation.—In the test involving pre-flotation, leaching, and re-treatment flotation, the grind, reagents, and other conditions for the pre-flotation were substantially as in test No. 194 cited in the foregoing. Leaching was done in the apparatus described in connection with Fig. 8, using a synthetic roaster gas, sulphuric acid, and salt as the leaching ingredients. The pulp was then filtered and the leach residue was washed. Altogether, there were three filtrations and three repulpings, the first filtration being on the leached pulp and the last repulping furnishing flotation feed. For re-treatment flotation the reagents were as follows: in the re-treatment rougher, sodium silicate 0.50 lb., tartaric acid 0.13 lb., oleic acid 0.053 lb. per ton of raw ore (pH, 6.70); in the re-treatment cleaner, sodium hydroxide 0.002 lb. per ton (pH, 6.78). Metallurgical results are shown in Table VII.

Direct leaching and flotation.—In the test involving leaching and flotation, 1,000 grams of ore was ground in the same way as for the tests already described. The ground pulp was dewatered by decantation and the mud was placed in a 4-liter beaker with 1,000 c.c. of hydrochloric acid (sp.g. 1.19), the pulp volume was made up to 3,000 c.c., and the leaching was continued overnight on a hot plate. This leaching was repeated once and was followed by washing with distilled water until no test for ferrous or ferric iron could be had with either ferrocyanide or ferricyanide.

The washed pulp was floated with sodium silicate 0.50 lb., tartaric acid, 0.13 lb., oleic acid, 0.53 lb., and sodium hydroxide 0.24 lb. per ton of raw ore, the pH becoming 6.78. Cleaning was done with sodium hydroxide 0.24 lb. and tartaric acid 0.03 lb. per ton at pH 6.85. Metallurgical results for this test (No. 342) and for another similar but larger scale test (No. 366-67) are shown in Table VIII.

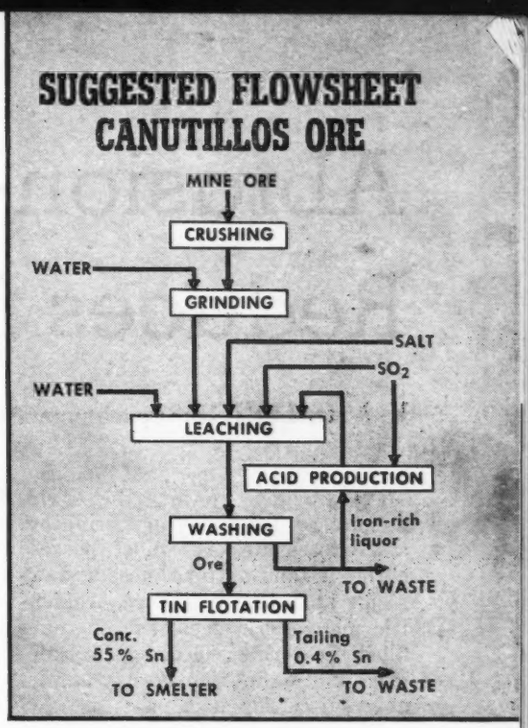
Principal impurities in the final concentrate are quartz, rutile, and barite, in the order named. One typical concentrate contained 10.0 percent SiO_2, 4.75 percent TiO_2, 1.07 percent $BaSO_4$; another concentrate with 46.1 percent Sn contained 0.58 percent Fe and 5.1 percent TiO_2. Most of the silica is locked to cassiterite, and most of the titania occurs as rutile, both free and locked with cassiterite.

With regard to the froths obtained in each case, unleached floats were satisfactory only if the bubbles at the top of the float had a partly open or glassy surface, the "lacey" type of float of Falconer and Crawford.[2] If this condition is not obtained, the float is generally too heavy and dirty. The float is usually a bright red-brown to clear chocolate color. The floats from leached pulps, on the other hand, have a highly flocculated or clotted look, are a bright mouse-gray in color, and manageable over a relatively wide range of conditions.

Choice of Method

Pre-floating the ore eliminates about two-thirds to three-quarters of the weight and up to one-half of the iron (see Table IV). These two factors mean that a leaching installation would be substantially more modest and that the consumption of acid (that is, of SO_2) would be cut approximately in half.

Against these advantages must be balanced the following: first, a substantial part of the tin lost by floating before leaching is not lost if leaching precedes flotation; second, two flotation operations are needed, one before and one after leaching; third, some operating difficulties may arise during leaching and re-treatment because of reagents carrying through from the pre-float. Our calculations favor leaching before flotation.



Summary of Results

On Canutillos ore assaying about 15 percent Fe and 2.8 percent Sn as cassiterite finely disseminated in a gangue of goethite and quartz, the optimum results that can be expected are as follows:

1. By gravity concentration, 24 percent grade and 26 percent recovery.
2. By straight flotation, 19 percent grade and 60 percent recovery.
3. By leaching followed by flotation, 55 percent grade and 85 percent recovery.

The last scheme, although relatively elaborate, gives results so much the best that it is economically sound, provided adequate ore reserves are available, even on the assumption that pyrite and salt are to cost each $10 to $12 per ton.

We acknowledge with thanks the cooperation afforded us by Messrs. J. Fredericus van Dorp, Moises Jacobson, and Cornelis van Lummel, of Bolivian Tin & Tungsten Corporation. It is also our pleasure to acknowledge the inspiring help that was afforded us by Sr. Simon Patiño, his son Sr. Antenor Patiño, M. le Comte Guy du Boisrouvray, Sr. Mariano Deheza, and Dr. Eduardo Fajardo, of the Patiño organization.

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Abrasion-Resistant Alloy Reduces Milling Costs

K. A. DELONGE, Development and Research Div., The International Nickel Company, Inc., New York

METALS which go into the equipment used for crushing, grinding, and processing ores must possess both outstanding toughness and extreme abrasion resistance. Austenitic manganese steel has for years filled the former need. Its high degree of toughness makes it admirably suited for such parts as jaw-crusher plates, gyratory bowls, and mantles. Under the heavy working pressures of these parts, this steel hardens at the surface by cold-working, with resultant increase in abrasion resistance. Below the surface the original toughness of the metal prevails. For some intermediate services, such as crusher-roll shells and certain jaw-crusher plates and gyratory bowls and mantles, where only moderate impact loads are involved, high-carbon and heat-treated alloy steels may offer better abrasion resistance while still possessing adequate toughness.

For those services at the other extreme which require little toughness but exceptional abrasion resistance, the alloyed nickel-chromium white cast-iron known by the trade name Ni-Hard is extensively used. Typical parts employing this metal are grinding balls, ball- and rod-mill liners, scoop lips, flotation and tailings pump parts, and classifier shoes. Here the prime requisite is resistance to the constant abrasive action of the wet ore.

Ni-Hard is alloyed with nickel and chromium to make it substantially harder, tougher, and markedly more abrasion-resistant than unalloyed white iron. Typical chemical composition and physical properties of this metal are as follows:

CHEMICAL ANALYSIS

	Percent
Total carbon	2.70 – 3.60
Silicon	0.40 – 0.60
Manganese	0.40 – 0.60
Nickel	4.25 – 4.75
Chromium	1.50 – 2.50

PROPERTIES

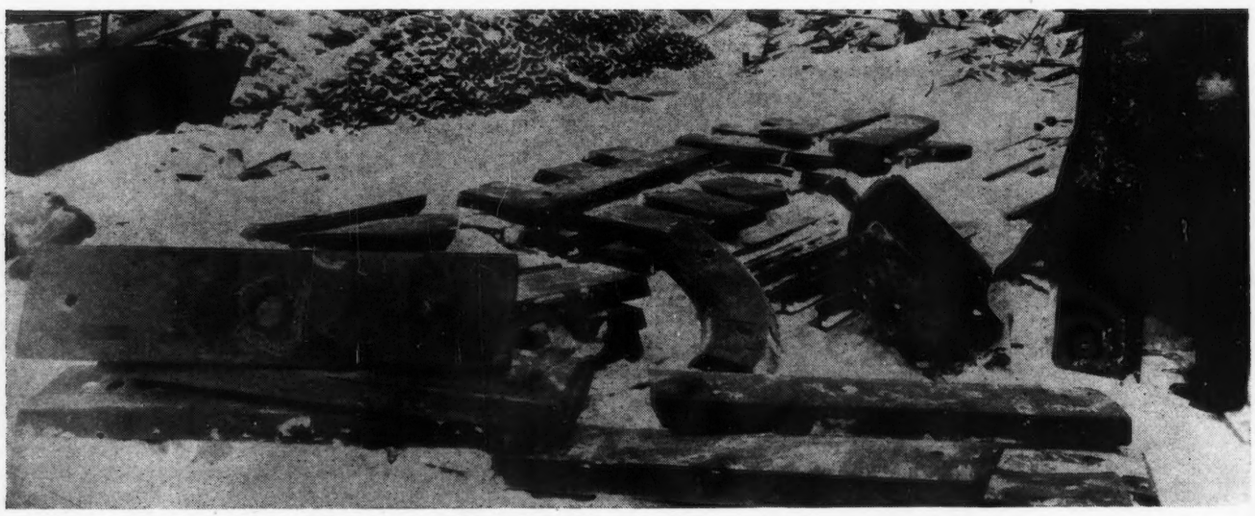
	Sand-Cast	Chill-Cast
Tensile strength, p.s.i.	40,000 – 55,000	50,000 – 75,000
Transverse strength (*a*)		
Load, lb.	4,000 – 5,500	5,000 – 6,800
Defl., in.	0.090 – 0.120	0.090 – 0.120
Brinell hardness	550 – 625	600 – 725
Fracture	White	White
Magnetic properties	Fully magnetic	Fully magnetic

(*a*) 1.20-in. in dia. bar, 12-in. span.

White irons in general owe their abrasion resistance to the presence of numerous free carbides in their microstructure. In unalloyed irons the metal supporting these carbides has a hardness comparable to carbon steel. In Ni-Hard not only are the carbides harder and stronger, but, also, the metal supporting them is much harder and comparable to a heat-treated alloy steel. This combination, which accounts for the possession of superior strength, toughness, and abrasion resistance, is achieved by the use of a small amount of alloy.

Chill-Casting Desirable

Whenever possible the metal should be chill-cast, because its hardness, strength, toughness, and abrasion resistance in this condition are markedly superior to the sand-cast condition. This improvement in properties is due to the refined grain size of the metal resulting from the rapid freezing rate at the chilled face. The chills used may be either one piece or "spot" chills separated ½ in. to 1 in. by



USED IN 6½x15-FT. MARCY ROD MILLS, with 2½-in. diameter rods, at the plant of the International Nickel Co., Ltd., Copper Cliff, Ont., spot-chilled nickel-chromium white iron liners of the type shown in the photograph have given a life of 541,981 tons of ore, compared with 250,498 tons handled by manganese steel liners.

molding sand, the choice of the chiller depending upon the foundry's facilities and the type of casting being made. Actual tests have shown chill-cast parts to outwear comparable sand-cast parts by as much as 50 to 100 percent.

Both sand- and chill-cast nickel-chromium white iron should be given a stress-relieving draw at 400 to 450 deg. F. before being placed in service. This treatment increases the strength and toughness approximately 50 percent over the "as-cast" condition without altering hardness or abrasion resistance.

Liner Use Outstanding

The outstanding application of Ni-Hard to date, from a tonnage standpoint, has been for ball- and rod-mill liners in both primary and secondary grinding mills in diameters as large as nine feet and with ball sizes as large as four and five inches. In this service austenitic manganese steel is not work-hardened sufficiently to offer maximum abrasion resistance, and unalloyed white iron is inadequate both from a toughness and abrasion-resisting standpoint. The marked advantage of nickel-chromium iron in this application is shown by the following data:

1. In 9 x 9-ft. grate discharge mills using 4-in. balls at a South American copper mine:

	Life of Shell Liners
Nickel-chromium white iron	6,200 hr. (av.)
Austenitic manganese steel	4,500 hr. (av.)

2. In 7 x 10-ft. mills using 2½-in. balls at a western Canada mine:

	Life of Shell Liners
Nickel-chromium white iron	33 – 39 months
White iron	12 – 15 months

3. In a 7 x 6-ft. mill at Madsen Red Lake Gold Mines, Ltd., the life of shell, man hole, end, and throat liners was:

	Nickel-Chromium White Iron	Austenitic Manganese Steel
Life in days	495	294
Tons of ore milled	195,765	116,449
Total cost per ton milled	1.21c.	2.22c

4. In a 7 x 10-ft. grate discharge mill using 4-in. and 5-in. balls at a Canadian gold mine:

	Nickel Chromium White Iron	Austenitic Manganese Steel
Life, tons of ore milled	313,980	150,569
Liner cost per ton milled	0.78c.	1.77c.

5. In a 9-ft. by 48-in. mill using 3½-in. balls at a Canadian gold mine:

	Nickel Chromium White Iron	Austenitic Manganese Steel
Liner life in hours	5,563	3,633
Liner life in tons of ore	117,280	75,865
Liner consumption, lb. per ton	0.24	0.36
Liner cost, cents per ton	2.1	3.9

6. In mills using 2½-in. diameter rods at the International Nickel Company, Ltd., Copper Cliff, Ontario:

	Dry Tons Ore Ground	Liner Cost per Ton of Ore
1938—Shell liners in mills 6½ x 12 ft, nickel-chromium white iron	523,786	0.527c.
Ni-Cr-Mo steel	402,607	0.856c.
Austenitic manganese steel	360,819	0.914c.
1944—Shell liners in mills 6½ x 15 ft.		
Nickel-chromium white iron	541,981	0.763c.
Austenitic manganese steel	250,498	1.871c.

Liner consumption, nickel-chromium white iron, 0.0988 lb. per ton.

Liner consumption, austenitic manganese steel, 0.1739 lb. per ton.

7. In 8 x 8-ft. grate-discharge mills using 4-in. balls at a South African copper mine:

	Life of Shell Liners
Nickel-chromium white iron	100,000 tons (plus)
Austenitic manganese steel	75,000 tons

8. In a 5 x 10-ft. rod mill grinding zinc-oxide sinter:

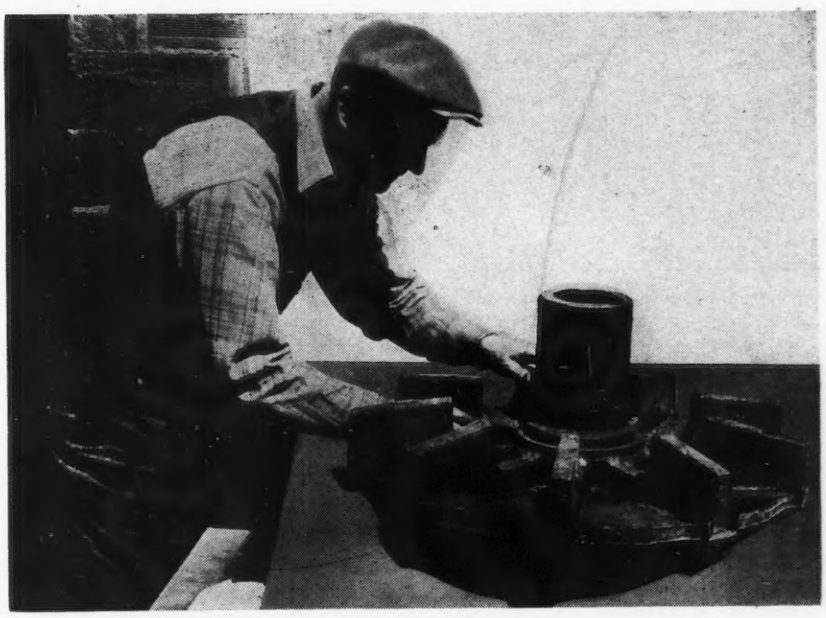
	Life of Shell Liners
Nickel-chromium white iron	52 months
Austenitic manganese steel	32 months

9. In a 7 x 8-ft. mill with 4-in. balls at a Canadian gold mine:

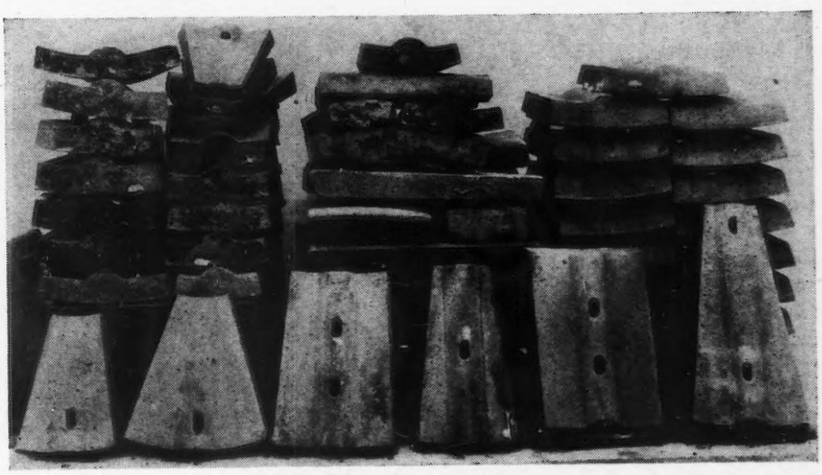
	Life of End Liners
Nickel-chromium white iron	190,033 tons
Ni-Cr-Mo steel	139,146 tons

For grinding-ball service two grades of nickel-chromium iron are recommended: sand castings for sizes up to 1½ in., and chilled castings for sizes from 2 to 4 in. The respective analyses and hardness levels for these balls are as follows:

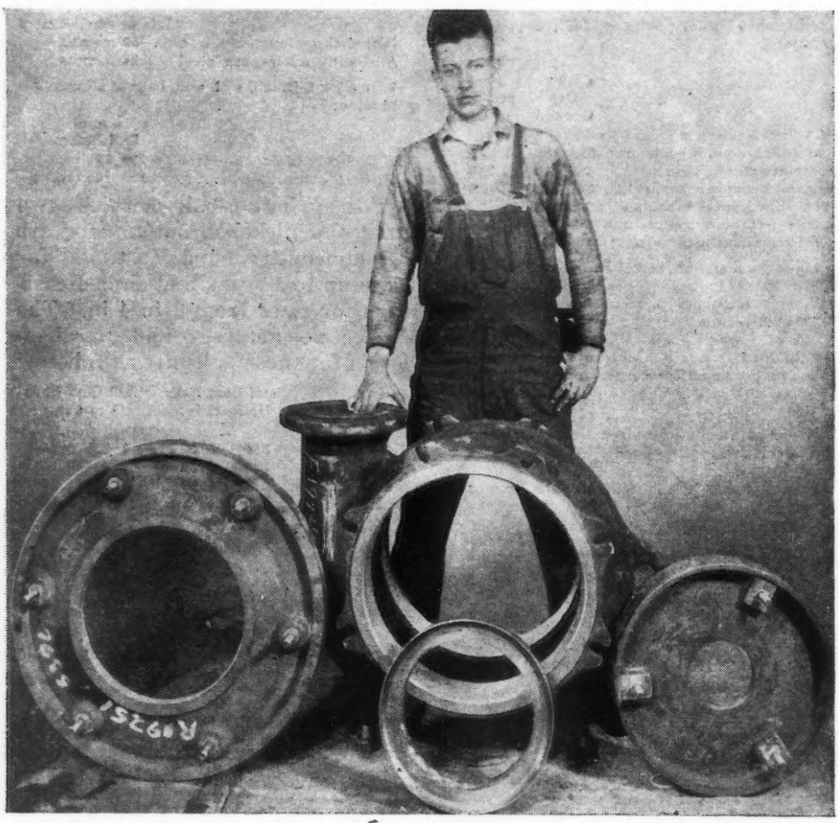
	Sand-Cast Balls (Up to 1½ in.) %	Chill-Cast Balls (2 to 4 in.) %
Carbon	3.00 – 3.50	3.00 – 3.50
Silicon	0.40 – 0.60	0.40 – 0.60
Manganese	0.70 – 1.00	0.70 – 1.00
Nickel	3.50 – 4.00	3.10 – 3.40



DENVER FLOTATION IMPELLERS cast in Ni-Hard have given 255 days of service at the International Nickel concentrator. Unalloyed white-iron impellers under the same duty last an average of only 141 days.



THESE LINERS of alloyed nickel-chromium white iron were cast for use in an 8-ft. by 22-in. Hardinge mill at the Golden Messenger Mines plant, at Helena, Mont.



THE SLUDGE PUMP PARTS shown were machined from Ni-Hard castings with carbide-tipped tools. Hardness is 600 Brinell.

	Sand-Cast Balls (Up to 1½ in.) %	Chill-Cast Balls (2 to 4 in.) %
Chromium....	1.50 – 2.00	1.70 – 1.90
Brinell hardness.....	575 – 650	650 – 725

The hardness levels shown prevail through the cross-section of the ball, even in the larger sizes. In grinding concentrated pyrite, 1½-in. sand-cast balls of this type have outlasted low-alloy white-iron balls by a 1.7:1 ratio. On conglomerate sand at the Calumet & Hecla Consolidated Copper Co. plant, 3-in. chilled nickel-chromium white-iron balls have outworn chilled unalloyed white-iron balls by a ratio of 2½:1.

In addition to balls and liners, Ni-Hard is well suited to withstand the constant abrasion encountered by the scoop lips of mill feeders. Records on both ball and rod mills show a superiority of 2:1 over steel and 4:1 over unalloyed white iron.

Wearing shoes on both rake and spiral classifiers represent another service where the prime requisite is resistance to abrasion. On an 8x20-ft. classifier at the Aldermac Copper Corporation property at Arntfield, Que., handling extremely abrasive ore, mild-steel shoes had a life of only 6½ months, compared to a life of 24 months for nickel-chromium white iron. In a spiral-type classifier at a large United States copper mine, Ni-Hard shoes were found to last three times longer than unalloyed white iron. Many mines throughout the United States and Canada are using these shoes.

Flotation and Pump Parts

Flotation impellers, pans, and hoods, and also tailings pump parts, require a high degree of abrasion resistance if frequent replacement is to be avoided. At the Calumet & Hecla Consolidated Copper Co. property flotation impellers and pans made of nickel-chromium white iron give a life of two years, compared to six to seven months for unalloyed white iron.

Comparative service data on tailings pumps are shown below:

1. International Nickel Co. 3-in sand pumps handling 72 percent solids:

	Life of Impellers
Nickel-chromium white iron....	1,319 hours
Unalloyed white iron.....	551 hours

2. At a Western zinc producer a 2-in. pump handling tailings which are 2 percent on 48 mesh, 46 percent solids.

	Life of Impellers
Nickel-chromium white iron....	90 days
Unalloyed white iron.....	25 – 30 days

3. At Poverty Hill mine, La Porte, Calif., in a pump with a 26¾-in. diameter impeller handling a quartz ore:

	Nickel-Chromium White Iron	Austenitic Manganese Steel
Life of casing, hours.....	600 – 700	525 – 600
Life of impellers, hours.....	400 – 450	250 – 300

4. At a Canadian gold mine the comparative life of tailings pumps is:

Nickel-chromium white iron.....	70 days
Unalloyed white iron.....	35 days

5. At Calumet & Hecla Consolidated Copper Co. old tailings are being dredged from a lake for reclamation by a 20-in. pump, which has given the following service:

	Nickel-Chromium White Iron	Unalloyed White Iron
Shell liner life, hours	3,500	700
Impeller life, hours..	1,850	500

In addition to the foregoing applications which involve mostly minor shock loads, nickel-chromium iron is used to a limited extent for small jaw-crusher plates, roll shells up to 48 in. in diameter, and stamp shoes and mortar dies and liners. In the Joplin, Mo., district, Ni-Hard jaw plates in a 36x42-in. crusher handled 400,000 tons of lead-zinc ore, against 225,000 tons for manganese steel plates. On the same ore 42x20-in. crusher roll shells of nickel-chromium alloy turned in a life of 76 days, versus 20 days for unalloyed white iron. At the International Nickel Company mill roll shell cheek plates made of this material have lasted four to six times longer than those of manganese steel.

At the Calumet & Hecla Consolidated Copper Co. plant steam stamp shoes weighing 850 lb. each are cast in nickel-chromium white iron and worn from an original thickness of 8½ in. down to 5 in. They give a life of 204 hours, compared to 128 hours for white iron. The alloyed stamps give much less trouble with breakage, because of their greater strength and toughness.

In the services just described it is essential that the toughest grade of the metal be applied. This calls for keeping the total carbon content under 3 percent, casting the wearing face against a chill, and applying the stress-relief annealing treatment previously discussed. It is important that the backs of jaw-crusher plates be either finish-ground or zincked to insure good seating.

Because of improved strength, toughness, and abrasion resistance, Ni-Hard insures a definite economic advantage in the replacement of unalloyed white iron and, with good judgment, frequently permits substitution for abrasion-resisting steels in those services where only moderate impact loads are involved.

Fusion-Piercing—A New Way of Making Blast Holes

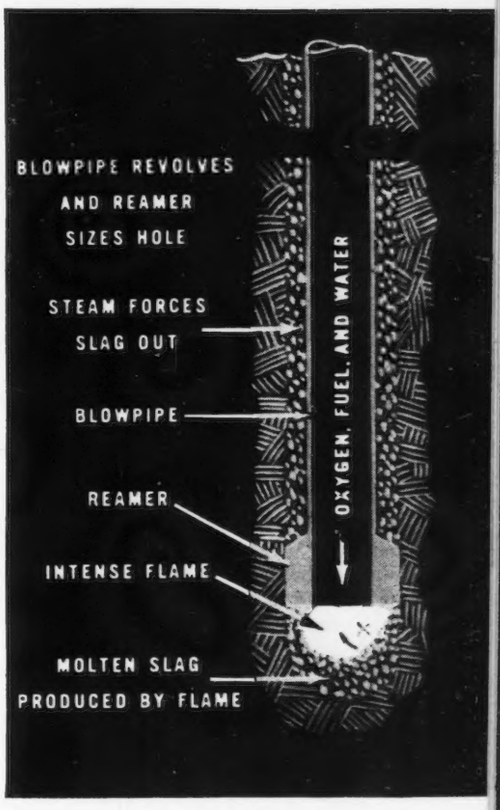
PRIOR TO THE WAR, a method for preparing blast holes in those iron ores that are difficult and costly to drill by conventional methods was being developed by the Linde Air Products Co. This method is now known as fusion-piercing. During the war it was necessary to discontinue all research activity on this process. Laboratory work was resumed last year, however, and active field tests are now being conducted in Minnesota, where these ores are very abundant.

With the Linde method for fusion-piercing, blast holes 6 in. in diameter can be driven vertically downward to a depth of 30 ft. by rapidly smelting the ore in a straight line. Laboratory tests indicate that the speed of piercing will be many times faster than for any other known method.

The intense heat necessary for the smelting operation is produced by a fuel containing suitable fluxing media and high-purity oxygen. The pressure developed by the combustion forces the molten material upward, as it is produced. This pressure, combined with the continuous downward movement of the revolving blowpipe, forces the molten ore and rock into the cooling water that is discharged from the end of the blowpipe. The intense heat changes the water to steam. Besides quenching and embrittling the slag, the steam separates the slag into fairly large particles and aërates them. The rapidly cooling slag is easily crushed by the reamer-grinder attached to the blowpipe. The end product, the mesh of which is rather small, is readily ejected from the blast hole by the escaping steam. See the illustration below at right.

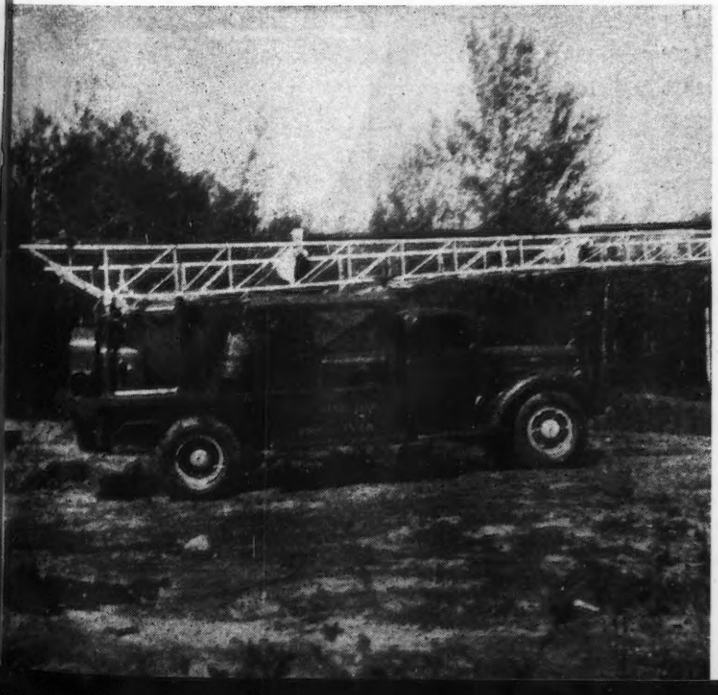
The development work on the fusion-piercing method has been directed toward making blast holes in low-grade, hard iron ores only. At present there is no reason to believe or anticipate that this new development will replace conventional methods of drilling in ordinary deposits.

This method is so radical in all concepts that it is not considered advisable to present laboratory data at this time. The better course would seem to be to wait for the records of actual field performance.

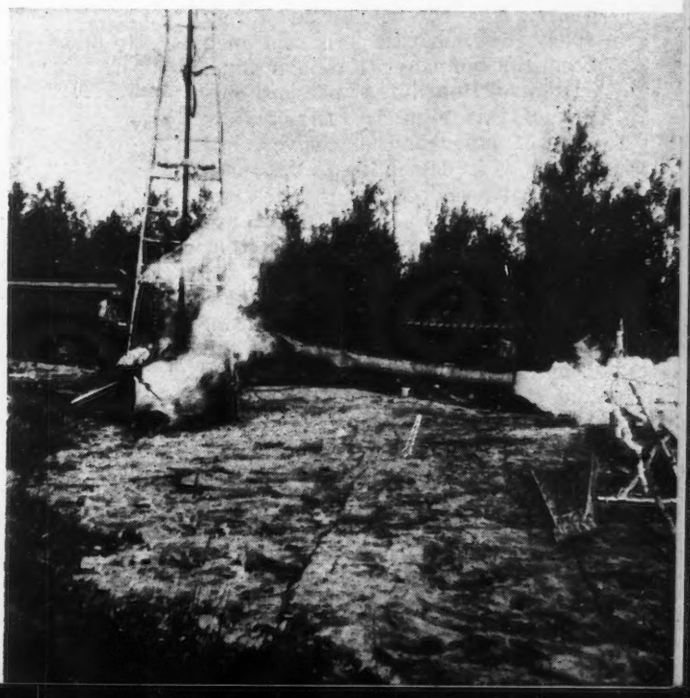


WHAT HAPPENS in the blast hole as the revolving blowpipe pierces the way.

ROTARY RIG with blowpipe mounted on truck which carries equipment for control of fusion-piercing process, ready to move to the site of a hole. This is now being used in field tests.



FUSION-PIERCING in progress. The blowpipe is seen in the upright rig. Gases, water vapor, and end-product slag are conveyed away from the hole by a length of flexible tubing.



Bombs Curb Jap Zinc Plant

ALLAN F. MATTHEWS, Arlington, Va.

JAPAN'S GREATEST ZINC PLANT, the Miike smelter, at Omuta, on the western coast of Kyushu, suffered only slight war damage, but it is currently operating at only 20 percent of capacity, due to shortage of ore. Maximum output, according to E. Shugiyama, plant superintendent, was 18,000 metric tons of retort zinc and 6,000 tons of electrolytic zinc annually.

The smelter was bombed by United States aircraft three times, all in the summer of 1945. The attacks of June 18 and July 27 were with incendiaries only, but the one of Aug. 7 included high explosive. As a result, production was cut in half following the July bombing, and it ceased altogether in August. Actually, the only seriously damaged unit was the retort plant, where walls and roof were burned and retort extrusion equipment was demolished. At present about half the quantity of retorts needed for full production can be made.

Ore Supplies Cut

Built in 1914 by the Mitsui Mining Co., the Miike smelter was the first modern zinc retort plant in Japan. Before the war, concentrates were obtained from Japan, Indo-China, Burma, Australia, and Canada, but only the first three were available, of course, during recent years. Now the smelter must rely solely on domestic ore, obtained from the company's Kamioka mine, in central Honshu. At present, output of this mine is restricted by lack of labor and explosives, but return of demobilized Japanese soldiers and allocation of industrial explosives by the U. S. Marines are expected to permit greater output at an early date.

The Kamioka ore assays about 5 to 7 percent zinc and 1 percent lead. Lead concentrate is reduced at the Funatsu smelter, near the mine, and zinc concentrate is shipped to Miike.

At the Miike smelter, concentrate is roasted in Dwight-Lloyd machines to bring the zinc content up to 65 percent. A charge of 100 parts sinter, 30 parts coke, and 5 parts coal is fed to the retorts, which are heated to about 1,400 deg. C. There are 12 pairs of distillation furnaces, only two of which were operating when I visited the plant in February. Each furnace contains 72 clay retorts 1.6 meters long.

Forced Labor Used

Distilled zinc contains over 2 percent lead, and it is therefore melted in small refining furnaces at 700 deg. C. The "MMC" grade zinc, which contains better than 98.6 percent zinc and is the equivalent of our Prime Western, is drawn off the top of the melt.

Workers on the payroll as of December 1945 totaled 2,671, including 1,558 Japanese men, 308 Japanese women, and 805 male forced laborers, mostly Koreans, awaiting repatriation.

At Omuta are a number of other Mitsui enterprises such as the Miike coal mine, which once produced 2,500,000 tons annually. Shopping and residential sections of Omuta are largely burned out. Temporary shacks are going up here and there, made of corrugated steel shipped from the great, undamaged Yawata Steel Works, to the north. The Miike Dyestuffs Co., which made explosives and liquid fuel from coal during the war, was badly hit, but is being rebuilt to return to producing dyes and pharmaceuticals. Oriental Light Metal Co. is converting from aircraft to kitchen utensil manufacture.

Marines Run Omuta

The city of Omuta is in the hands of hardly more than a dozen U. S. marines, who live luxuriously in the Western-style Mitsui Club. A little street patrolling is done, but their principal occupation is the unsung, but hazardous, job of directing disposal of munitions. The Japanese, deciding to be very cooperative, even included in their submitted inventory report, "11 foreign bombs," a few of our dud incendiaries they had carefully collected.

Production of Miike Smelter, Omuta, Japan

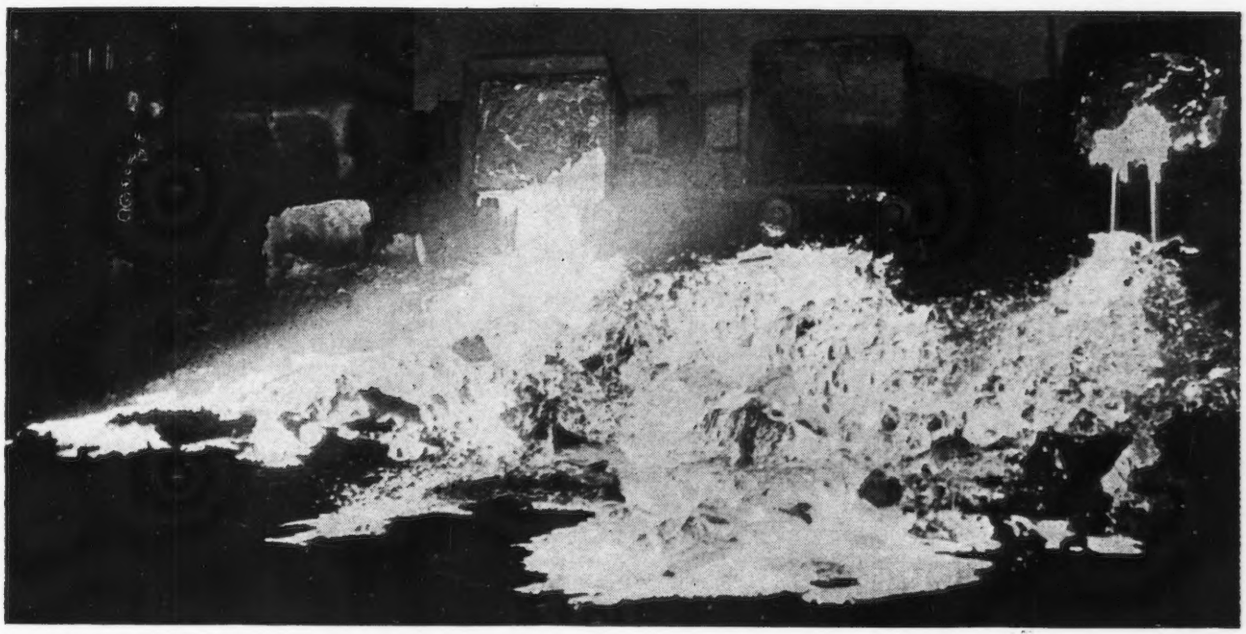
METRIC TONS

Month	Retort Zinc	Zinc Dust	Electrolytic Zinc	Cadmium	Nickel	Copper
1945						
January	1612	160	560	2.9	4.0	84
February	1377	140	452	1.3	3.6	58
March	1414	125	544	1.5	3.3	84
April	1210	105	508	1.1	4.2	80
May	1262	139	340	1.1	4.0	87
June [a]	707	71	257	0.7	2.1	64
July [b]	499	24	212	0.4	3.0	30
August [c]	....	....	6	....	....	....
September	139	7	86	....	....	10
October	146	14	126	....	....	....
November	132	15	205	....	....	....
December [d]	239	19	245	....	....	....
1946						
January [d]	285	26	258	1.0	....	....
February [d]	341	31	232	1.0	....	....
March [d]	417	38	258	1.5	....	....

[a] First bombing. [b] Second bombing. [c] Third bombing. [d] Planned output as of December 1945.

Peace Puts New Burden on Expanding Swedish Mines

HANS G. TONNDORF, New York, N. Y.



DUMPING SLAG from the Boliden copper smelter, which processes much of Sweden's annual output of about 16,000 tons maximum. Consumption normally is about 50,000 tons, giving the highest per-capita rate attained in any country in the world.

IN SWEDEN, as elsewhere, the war accelerated a tendency toward economic self-sufficiency, not only in manufacturing but also in supply of raw materials in general and minerals in particular. The wartime expansion of Sweden's mineral industries thus continued a growth that began with the operations of the Boliden Mining Co. in the Skelleftea field late in the twenties. There, at a latitude of 64 deg., a widespread area of rich ore deposits was discovered, including ores of gold, copper, lead, arsenic, and other metals.

Imports Required

During the thirties, Swedish nonferrous metal production increased greatly, but even so it was unable to keep pace with domestic demands, and at the outbreak of war, Sweden was still largely dependent on imported metal. Therefore, when its western trade was cut off in April 1940, Sweden faced the necessity of increasing mineral production to the utmost and of building or enlarging smelting and refining plants. Much of this burden was carried by the Boliden company, which greatly expanded its activities during the war. Among Boliden's achievements was the new 60-mile ropeway, which is described in *E.&M.J.* for July 1946.

Iron Ore. There was, of course, no danger of deficiency of iron ore, of which Sweden has long been an outstanding producer and exporter. Iron mines in central Sweden provide the basis for the domestic iron and steel industry. These ores are noted for their purity, in that they assay 50 to 55 percent iron but less than 0.01 percent sulphur and less than 0.005 percent phosphorus.

The iron ores of northern Sweden (Lapland) are somewhat higher in phosphorus but are believed to be the highest grade in iron in the world, the iron content ranging between 61 and 70 percent. This ore, which is largely exported, is mined from open pits, and output per man runs 4 or 4.5 times as high as in central Sweden.

Prewar iron-ore production ran to 15,000,000 tons per year, of which 14,000,000 was exported. Germany was the chief customer, and when the war cut off other markets, Germany continued taking ore in exchange for coal and coke. By 1944, however, the weakening of Nazi power made it possible for Sweden to reduce shipments to Germany, and in 1945 iron-ore exports fell lower than in any year since the eighteen nineties.

Iron ore is again flowing to England, Belgium, and Poland, but lack of exchange, particularly with Eng-

land, and the depressed condition of European industry in general, have reduced the volume of shipments. Freight rates of more than four times the prewar rate also make trade difficult; in fact, high rates have thus far prevented any postwar iron-ore shipments to the United States. For example, the cost of shipping a ton of ore to England from Narvik (27.9 s.) is about the same as the price of a ton of ore f.o.b. Narvik (28 s.).

Swedish iron mining therefore must await restoration of its export markets. This will require general rehabilitation and progressive industrialization of Europe, partial restoration of the German steel industry, and increased outlets in the United States. Meanwhile, Swedish miners are employed in non-ferrous mining, and no great hardship has as yet been felt over the cut in iron-ore demand.

Gold. Gold, which occurs at Boliden and has given that company its name, is second in importance to iron in the Swedish mining industry. Boliden, the richest gold mine in Europe, has an orebody averaging 0.5 oz. gold and 1.6 oz. silver per ton, as well as 1.5 percent copper and 7 percent arsenic. Gold production fell off during the war from 6,093 kg. in 1939 to 3,876 kg. in 1944. As a result of the revaluation of the Swedish krona, the gold price was reduced recently by 650 kronor per kilogram, with the result that Boliden's return on its gold production is diminished by about $500,000.

Copper. Just prior to the war, Sweden's output of copper had risen to 11,000 tons annually, mostly from Boliden. Imports of copper at the same time had reached a level of 50,000 tons annually, chiefly from Chile and the United States. Although some of this tonnage was stockpiled, the figures nevertheless imply the highest per-capita copper consumption in the world for Sweden's 6,500,000 inhabitants.

During the war some new copper mines were opened in the Boliden area, among them the Kristineberg mine, starting point of the 60-mile tramway. Copper ore output was almost quadrupled (Table II), and in 1944 30,000 tons of copper concentrate was obtained from Finland. Prospecting activity continues.

Boliden's refineries at Rönnskär, on the Baltic, were enlarged, and the Svenska Metallverken, the country's largest copper consumer, built a new electrolytic plant with an annual capacity of 2,500 tons. Copper smelting of Norwegian sulphide ores had to be reduced, but, on balance, Sweden's copper metal output rose from about 11,500 to more than 16,000 tons. (Table III.)

Table I. Swedish Iron Ore Exports.

	Metric Tons
1939	13,600,000
1940	10,100,000
1941	9,500,000
1942	8,600,000
1943	10,300,000
1944	4,600,000
1945	1,200,000

Table II. Swedish Mine Output Expands During War

	Metric Tons of Ore	
	1939	1944
Gold	242,280	134,000
Silver-lead	14,195	22,100
Copper	16,434	58,300
Zinc	63,826	59,900
Andalusite	.....	7,800
Chromite	.....	127
Nickel	.....	31,600
Molybdenum	.....	43
Tungsten	178	476
Manganese	6,085	24,300
Sulphur	191,737	317,500

Table III. War's Effect on Sweden's Metal Output

	Metric Tons	
	1939	1944
Gold	6,093 (kg.)	3,876 (kg.)
Silver	20,488 (kg.)	32,613 (kg.)
Lead	.....	7,913
Zinc	.....	1,790
Copper:		
Electrolytic	8,414	15,858
Fire-refined	3,044	347
Aluminum	2,582	3,836
Nickel	.....	713

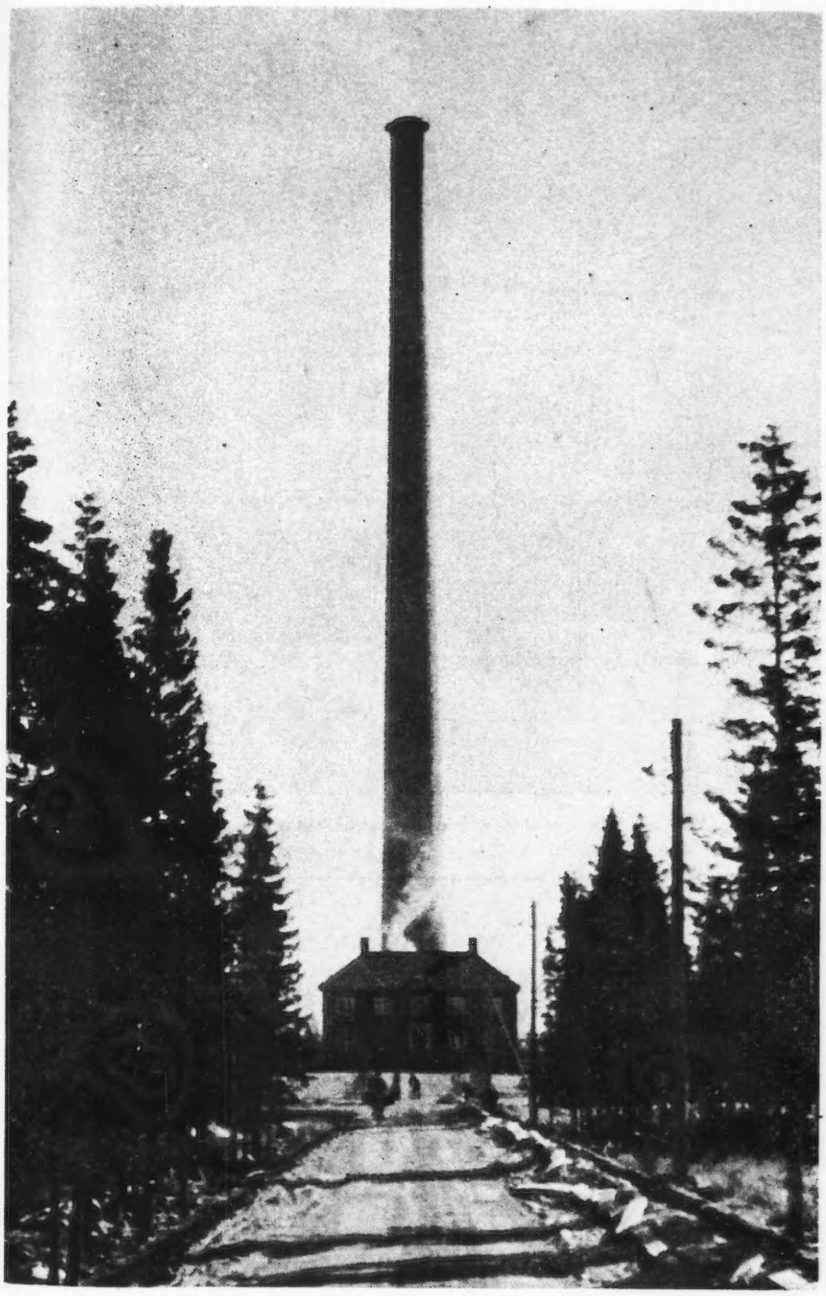
Zinc. Sweden possesses considerable deposits of zinc ore, but the domestic industry has languished to the point where in the prewar years the zinc ore mined in central Sweden by La Vieille Montagne went to Belgium, and domestic requirements were covered by imports of zinc. This exchange of ore against metal continued during the war, though on a reduced scale. In 1944, Trollhattans Elektrothermiska resumed production of zinc, discontinued in 1930, at a rate of about 2,000 tons of high-grade annually.

Lead. Lead ore has been mined for many years in Sweden, but, like zinc ore, it has generally been exported in exchange for the metal. Domestic smelting ceased in 1927. It was resumed in 1942, production reaching 8,000 tons of lead in 1944, which is about one-third of normal requirements. The biggest producer is the Boliden company, the ore coming from the rich deposit of Laisvall, discovered in 1940, and being smelted at Rönnskär without prior roasting. Lead ores from central Sweden are smelted in three smaller plants.

Ferro-Alloys. Critical shortages of ferro-alloy metals were averted by expanding Sweden's hitherto inconsiderable production. Manganese ore output was tripled, much of it from manganese-bearing iron ores in central Sweden. The Boliden company mined a nickel orebody at Lainijaur, and recovered 700 tons of nickel, in 1944. Tungsten ore output tripled, and chrome and molybdenum mining were begun.

Aluminum. There is no production of magnesium in Sweden and only one small producer of aluminum, the Svenska Aluminiumkompaniet, a Norwegian-controlled company. Between 1939 and 1944, aluminum output rose from 2,500 to 3,800 tons. During the war neither bauxite nor cryolite, normally supplied by Norway and Greenland respectively, was available in Sweden; but the industry maintained itself by substituting andalusite for bauxite, and by making synthetic cryolite from domestic fluorspar. Prior to the war, Sweden imported about half its consumption of aluminum, which reached about 6,000 tons annually. Demand for the metal is increasing and will probably be supplied largely by imports.

Arsenic. Boliden constitutes the world's largest deposit of arsenic, a fact that has thus far been mainly a source of trouble. Running as high as 25 percent arsenic in some sections, the orebody presents a treatment problem, which has resulted in the location of the smelter on a small remote island on the Baltic and the construction of the highest smelter stack in Europe (476 ft.). Although some of the arsenic unavoidably produced has been dumped into the ocean, there has been a limited demand abroad. Output has run about 20,000 tons of



THE HIGHEST STACK in Europe towers 145 meters (about 476 ft.) above the Ronnskar smelter of the Boliden Mining Co. Height is necessary to prevent local damage from high arsenic content of fume. Ore smelted may run as high as 25 percent arsenic.

As_2O_3 annually. During the war, Germany wanted huge quantities of arsenic, but her requests were refused. Boliden research men are developing new uses for arsenic in the hope of disposing of the current output, which is being stored. One such use is an improved wood preservative that may become an export item.

Sulphur. The increase of sulphur output during the war may be attributed to improved transportation facilities in the Boliden area. At one mine, 120,000 tons of sulphur ore was mined annually, but it could not be moved, although up to 250,000 tons of sulphur had to be imported. After 1942, sulphur production was diverted from metal smelters to the oil-shale plants, where it proved more economical.

Oil Shale. Although Swedish interests have been engaged for nearly 30 years in production of oil from Estonian shales, domestic oil shales lay untouched until the war. Oil content of Estonian shale runs up to 20 percent; Swedish shales contain only 4 to 6 percent. However, two plants were built by the State during the war, the larger of which, Kvarntorp, in central Sweden, may stay in business. Its annual capacity is 75,000 tons. With some further investment, Kvarntorp is believed to be capable of entering competition by 1951. By-products such as sulphur, gasol, and building plates will help.

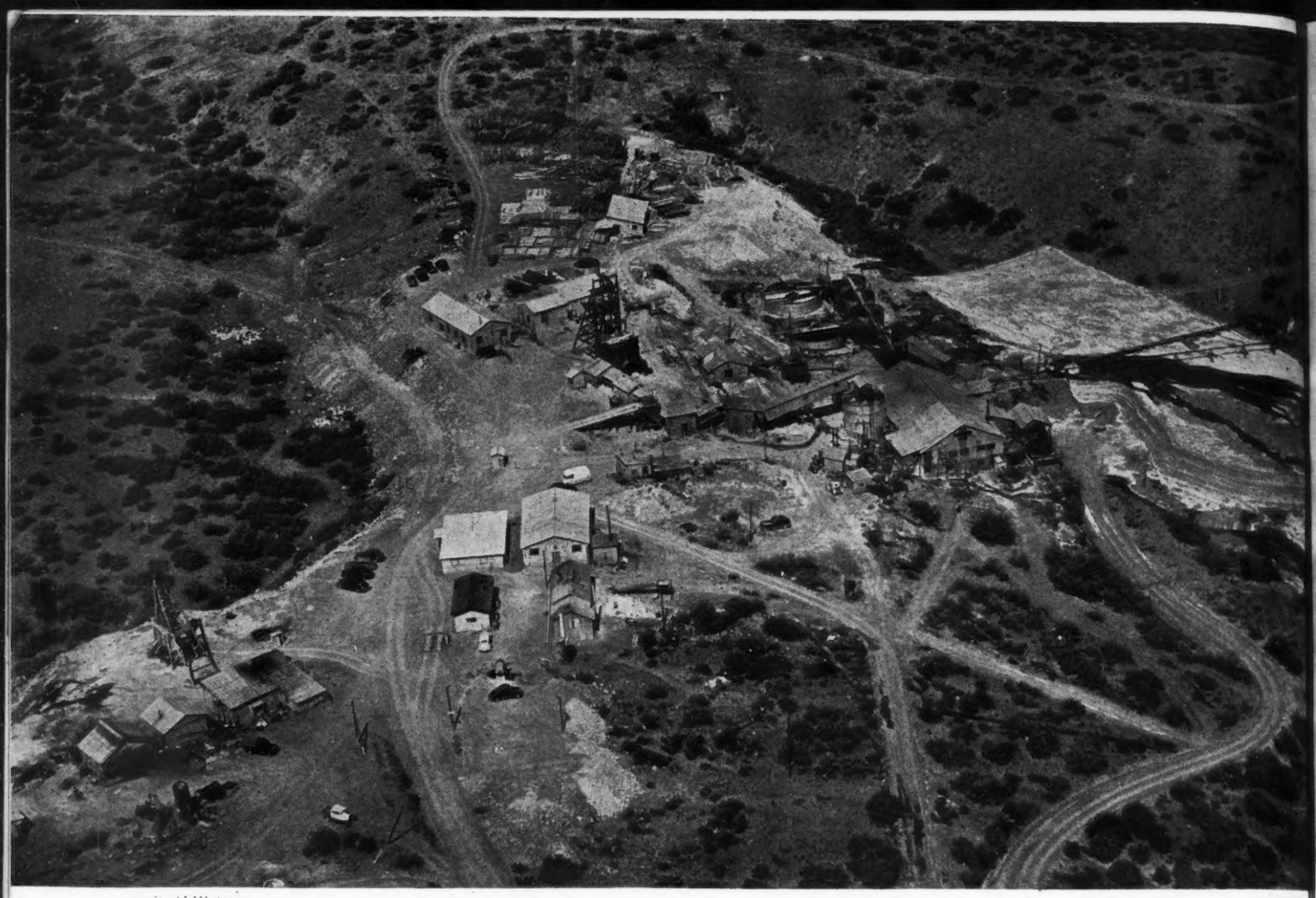
The Outlook

Despite the substantial expansion of Sweden's mineral industries during the war, it is apparent from this review that the country is by no means self-supporting in any of the non-ferrous metals. Only by drastic curtailment of consumption did it survive the war years. Copper consumption dropped from 50,000 to 20,000 tons annually; lead fell from 25,000 tons to 12,000 tons; zinc, from 16,000 to 10,000 tons. Substantial emergency stocks of metals built up before the war were of great help in this period.

Because of the urgent need for metals, cost considerations in Swedish mines have been secondary. Prices of metals have in general been fixed at a level higher than that in the United States or Great Britain. For example, copper sold at the equivalent of 16.8c. U. S. per pound and lead at 9.7c. per pound.

As imports of metal increase, Sweden's mines will unquestionably face a period of readjustment. Under her traditionally liberal trade policy it is most likely that metals will enter the country duty-free, and therefore only those mines will survive that can compete with imported metal. For a time recently there has been heavy downward pressure on metal prices in Sweden because of these growing imports, but in view of the continuing unsettlement in metal markets everywhere, the future is not easy to forecast.

However, it seems safe to assume that unprofitable copper mines in Sweden will shut down, once the present period of scarcity and strong worldwide demand for copper is over. It is also likely that Swedish production of nickel, lead, and possibly zinc will be abandoned when the supply situation becomes normal. Sweden will then again turn to imports as the chief source of supply of non-ferrous metals.



SURFACE PLANT of the Iron King mine of Shattuck Denn Mining Corporation, Humboldt, Ariz. Mill capacity is 375 tons per day. New steel headframe, near center of photograph, serves 1,150-ft. vertical shaft, which will be sunk to 1,220 ft.

Iron King Obtains Fill By Block-Caving Waste

H. F. MILLS, Manager, Iron King Mine, Humboldt, Ariz.

THE IRON KING MINE, at Humboldt, Ariz., which is owned and operated by the Shattuck Denn Mining Corporation, of New York City, was opened in 1906 and partly developed to a depth of 400 ft. Because of the complex sulphide ores encountered, the property was abandoned until 1936, when it was sampled and considerable test work was done to determine a flowsheet for a flotation mill. Gold, silver, lead, and zinc are contained in the exceedingly fine-grained complex sulphide ores. The gangue is chiefly pyrite with some chert.

Recoveries obtained by test work and later in actual mining practice were not good, but were sufficiently encouraging so that in 1938 a 140-ton flotation plant was built. This mill has been in constant operation ever since, and its capacity has been expanded to 375 tons per day. Further enlargements are being planned.

Ore deposition occurs in a sheared zone 80 to 100 ft. wide, in a belt of Pre-Cambrian schist which extends for several miles on either side of the mine. The orebodies are northward-raking shoots with horizontal lengths ranging from 80 to 1,000 ft. Widths average 6 ft. with maximums of 20 ft. These shoots are arranged in an echelon pattern over a length of 3,000 ft. In the upper levels, usually only one shoot of ore occurred at any one point along the strike of the formation and the axes of the echelons were about 15 ft. apart, perpendicular to the strike. At depth, the same pattern occurs, but overlapping of oreshoots is common, resulting in an increase of the minable area.

The original hoisting shaft is a 650-ft., two-compartment, inclined opening following the dip of the vein. Four years ago a new vertical shaft was sunk in the footwall and equipped with a 60-ft. steel headframe and a 100-hp. double-

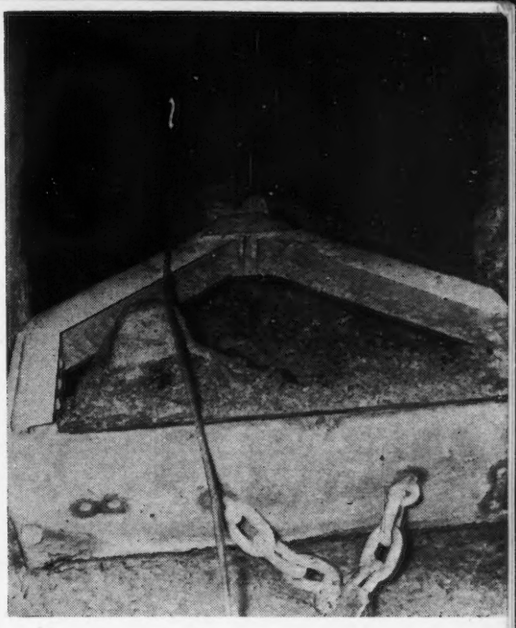
drum hoist. A double-deck cage is hung on one rope and a three-ton skip on the other.

Sinking operations have been continued. The present shaft bottom is at 1,150 ft. and further sinking will carry it to 1,220 ft., after which the stations for the 1,040 and the 1,150-ft. levels will be cut, and pockets and air-operated loading cartridges will be installed below the 1,150 station.

Approximately two-thirds of the mining at the Iron King is done by shrinkage stoping. However, in the north part of the mine is an area in which the schist is relatively weak, especially the hanging wall. Here horizontal cut-and-fill is used, carrying the fill close to the stope back. In certain large shrinkage stopes where the ore broke coarse, large control draw-points were substituted for the conventional chutes and the ore was loaded by slushers and ramps, or by mucking machines.

In the cut-and-fill stopes, 5-hp. air slushers using ⅜-in. hemp-center preformed wire rope are used for bringing the broken ore to the raise and for spreading waste fill which is dropped from the level above through a raise.

H. F. MILLS, manager of Iron King mine.



A 42-IN. SCRAPER slushes fine waste from caved block to transfer raise.

New Caving System

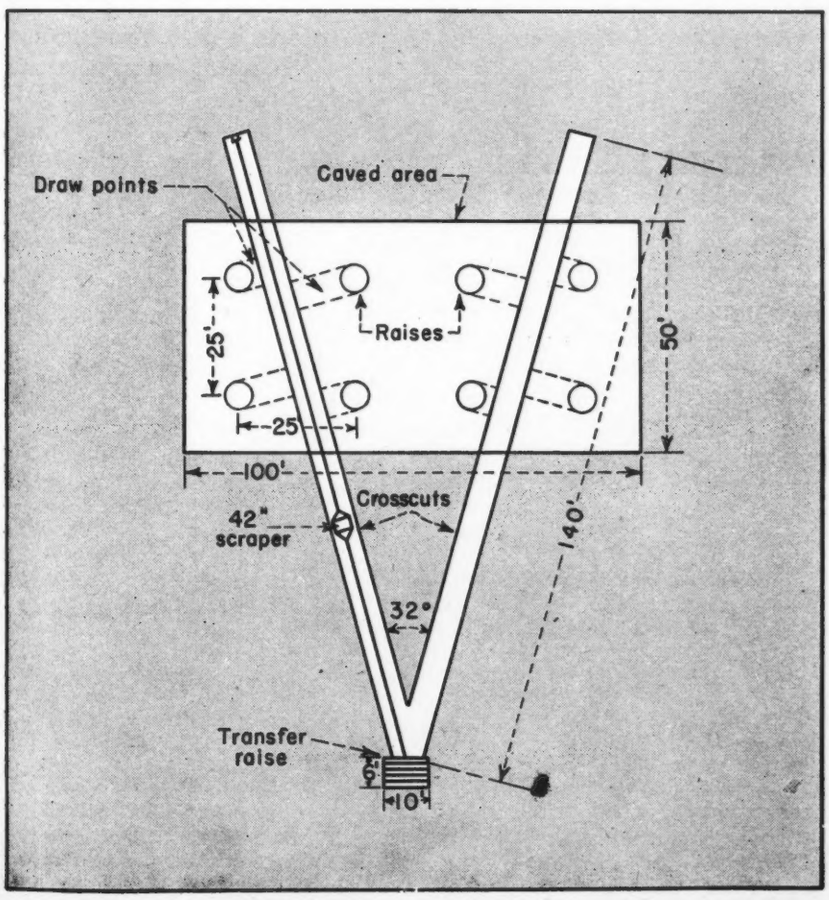
In the past, waste for filling was obtained from hanging-wall crosscuts driven from the level above at the top of the stope raise, or from inclined "bean-hole" raises from the stope itself. These methods were costly, and these "bean holes" seriously weakened the stope wall.

To provide a large source of cheap filling material, a block-caving area has been developed in a belt of laminated schist belt in the hanging wall. Starting from the top of a transfer raise on the 600-ft. level, two crosscuts 140 ft. long were driven at an included angle of 32 deg. Four raises were located in each of the crosscuts, and a block 50 x 100 ft. was undercut 20 ft. above the 600-ft. level, leaving 60 ft. of schist between the vein and the near side of the block to be caved.

Although the hanging-wall schist is relatively soft and highly laminated, it is also somewhat plastic. Thus it was doubtful if it would crush and cave, if undercut only. Accordingly, a narrow cutoff was carried up on each end and on the footwall side of the block.

The block is now moving and crushing, and the stope filling in very small grain sizes is available at all draw-points. These are each equipped with a sliding timber stop. A 15-hp. electric slusher hoist, with small drums and equipped with ⅜-in. hemp-center preformed wire ropes, pulling a 42-in. scraper, delivers the fill material to the transfer raise at a rate far in excess of any filling requirements.

With this method, if the block caves to the *caliche* surface capping, enough fill will be provided at a greatly reduced cost for a number of years of filling operation.



PLAN OF BLOCK-CAVING SYSTEM used to obtain broken schist for stope-filling

The Iron Country a Year After the War

A. H. HUBBELL, Managing Editor

There is always something new on the Lake Superior ranges. Production of concentrates from taconite is likely within two years. Planned innovations include a stripping technique employing a huge excavator and conveyors. Tests with "fusion-piercing" of blast holes are under way.

WARTIME FORECASTS to the effect that the great pent-up domestic demand for goods of all kinds would require production of iron and steel at a high level after the war, and thus in turn sustain a good postwar demand for iron ore, have proved true for the Lake Superior iron mining companies, despite the steel and coal strikes in the first six months of 1946, which seriously interfered with steel production. Although these companies likewise suffered a loss of production early this year by reason of a strike, it is expected that ore shipments from the ranges will not fall below 60,000,000 tons in 1946, a tonnage achieved or surpassed by a small percent in only five separate years in Lake Superior iron-mining history before the war. The very high ore production records established during the war are not likely to be repeated, and it would not be good for the Iron Country and the nation at large if they were.

Related to the outlook for ore production is the improvement in the labor situation on the ranges which has come about since the miners' strike. Though labor matters still take much of management's time, the stoppage of work, which began early in February and lasted from one month for the largest company to three and a half months for most of the others, is said to have had a beneficial effect on the willingness of the men to work. With the return of veterans to their jobs, moreover, the supply of labor has improved.

Thus the present situation in the Lake Superior industry appears to be one of a fair degree of employment and production. The casual visitor sees a picture of industrial tranquillity. On the one hand, the miners received their strike settlement wage increase of 18½c. per hour last spring and on the other the operators in June were granted a 50c. horizontal increase in the price of ore by OPA (this on the dubious assumption that the latter increase would take care of the former). All efforts are being made to get as much ore as possible down the Lakes before the shipping season ends.

What the Iron Country Thinks About

Life, however, is not as simple for the iron-mining executive and his staff as this might suggest. Some of the problems that come up have to do with iron mining today, others with the industry tomorrow, and still others with a future which is not clearly seen.

Today's greatest difficulty revolves around labor and the inconvenient amount of time that must be devoted to discussion of labor matters, which nevertheless are often relatively trivial affairs.

Vying with labor in importance, if not preceding it, though primarily a matter for long-range study, is the problem of iron-ore reserves, hackneyed as a subject no doubt, but vital. Expressed otherwise, it is the problem of the future ore supply for the furnaces, of the life of the Mesabi communities and those of the other ranges and the livelihood of their residents, and, third, of the continuing flow of important tax monies into the coffers of the state, the county, and the communities mentioned.

Wanted: Better Products, Lower Costs

Linked with the subject of ore reserves is the whole group of technological questions concerning ore discovery, conservation, and utilization, such as the need for closer work and better methods in exploring and drilling; for lowering mining costs, particularly in the underground mines so that their ores may compete more evenly with ores from the open pits; also the

progress of research in the beneficiation of low-grade ores, including the taconites, and the ways of conducting such work and developing better lower-cost processes.

Likewise related to the problem of ore reserves is the question of the possible importation on a greater scale of foreign iron ore that will supplant or compete with Lake ores, with or without the facility of a St. Lawrence seaway. This concerns the Lake Superior operator as well as the steel man. It provides the former with a further incentive for getting ore grades up and production costs down.

Mine Taxation, Royalties and Freight

Figuring importantly in production costs, and in Iron Country thinking and talk, are the items of taxes, royalties, and freight. In Minnesota especially, iron-ore taxation is notoriously heavy, and on all the ranges the major part of the annual levy is made on the ore that remains in the ground rather than on the tonnage produced. Thus the system in vogue serves as a spur to the operator (who pays all the taxes) to mine out a deposit as quickly as possible before taxation consumes its value.

As to freight rates and royalties, the amount of the combined rail and boat charges for transporting the ore from the mines to the furnaces via the Great Lakes has long been a matter of argument. Likewise where a property is leased, the royalty paid to the fee owner and other lease provisions often prove onerous when ore conditions change.

To the foregoing sources of commonly heard complaints one may add that the price of iron ore is unsatisfactory to many, even with the rise of 50c. permitted by OPA—this with good reason.

All these questions, problems, and "gripes" must be remembered in considering the Iron Country situation.

Lake Erie Price of Iron Ore Mesabi Non-Bessemer

1920-1945

1920	$6.55
1921	5.55
1922	5.05
1923	5.55
1924	4.75
1925–28	4.25
1929–36	4.50
1937–39	4.95
1940–45	*4.45

* Increased to $4.55 in December 1945 and to $5.05 in June, 1946.

Lake Superior Region's Dimensions Big

Geographically, the Iron Country is large, in keeping with the magnitude of its mining industry. To include its six ranges, three of which are in northern Minnesota and three in northern Michigan (Wisconsin having the west end of one of these), a rectangle drawn on the map would have to be 325 miles by scale from east to west and 160 miles from north to south. A still larger rectangle would be required to admit the iron-producing areas adjacent to Lake Superior on the Canadian side.

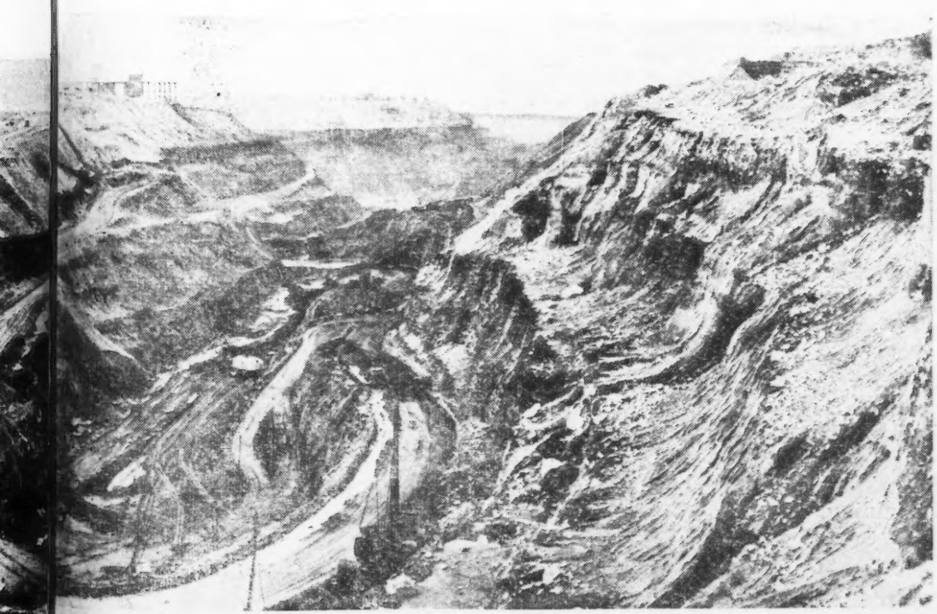
The visitor finds an industry employing, in 1946, a total of 23,000 men distributed at approximately 120 active mines, open-pit and underground. Two-thirds of these mines are in Minnesota, most of them being open pits, and one third are in Michigan, where they are almost wholly underground. Wisconsin has two of the mines, both of which are underground. In contrast to the large number of mines, the number of operating companies or groups is small, because iron mining, like steel making, is and must be a large-scale business.

One may note in passing that the total number of employees at present is 1,000 less than it was in 1943, but 1,500 more than in 1945, this demonstrating how the supply of labor dipped before the war ended.

Ore Shipments and Reserves and Depletion

Statistics show that ore shipments from the start—50-odd years to 90 years ago, depending on the range—up to the beginning of the present year, have totaled more than 2¼ billion tons. The remaining reserves of merchantable ore, including the wash and jig ores, are estimated at not quite 1¼ billion tons, as of May 1 last year, most of it being in Minnesota. The difference in the dates of reckoning the shipments and the reserves may be neglected. The figure for ore reserves might be a little bigger, if it were not for the reluctance of operators to find new ore much before it is needed, thereby causing it to be put on the tax rolls, where it would stay, subject to annual levies until mined. It might be still larger if the serious optimism of those who do not agree with the estimate of reserves given could be crystallized into ore—and geophysical exploration and improved drilling technique may yet disclose now unknown extensions of known deposits. Yet all these additions would hardly increase greatly the quotient representing the years of life remaining that is obtained by dividing the reserve tonnage figure by a reasonable annual rate of shipment.

An aspect of the reserve situation is that the pattern in which the iron ore holdings, whether fees or leases, are distributed among the operators suggests that some mining companies are better off than others in respect to future ore supplies. At the start of the 1944 shipping season, for example, one



THE WEGGUM MINE (formerly the Philbin), near Hibbing, on the Mesabi Range—a State lease operated by Butler Bros. Photo by Schawang.

company held somewhat more than half of the reserves estimated to be remaining, these holdings having been brought together early in the century when the company was organized. Two other companies held approximately 20 percent, about evenly divided, and six others had roughly half of the remainder. The rest is partly state-owned. This pattern is not greatly different from what it has been and should not change materially for some years to come. In any analysis, the tonnage held by each operator would have to be considered in relation to his normal requirements. The picture of actual ownership and control is exceedingly complex.

In Iron Country conversation the term "independent" is often heard with reference to some operator or other or to a group of operators. If one asks for a definition, the reply is varied. The confusion in part reflects the complexity in mine and furnace connections. At times the term is used to denote an ore-mining company which is not controlled by a consuming interest. More commonly it is employed loosely to indicate those operators who, collectively, have the smaller part of the ore reserves.

Ore Price Too Low

Little ore has ever been sold at the Lake Erie published price. Normally this is established by the first sale or two at the start of the shipping season. Business is done at varying discounts. With the imposition of control during the war, at a time when the Lake Erie price was low, as the accompanying table shows, prices were frozen at this low level for the war's official duration, save for the moderate and inadequate increases granted in the last twelve months, first one of 10c. for open-pit mines and 20c. for underground properties to meet the new shift differentials in pay, and of 50c. horizontally in June to take care of the 18½c. wage increase granted a few months before. Thus the current official price of ore, even with these additions, is only slightly higher than it was in the prewar, or 1937-1939 low-price, period.

Present Ore Reserves Still Important

Despite current talk of approaching exhaustion, this reserve of iron ore, of somewhere between 1¼ and 1½ billion tons, is still an important tonnage. It is more than half of the total production to date. Public concern about the depletion indicated is proper, but there is no cause for panic. The day of exhaustion for this reserve is indeed approaching, as for every mine and mining district elsewhere. The industry is aware that a mine is a wasting asset and has been making its preparations. It is the public that had needed educating.

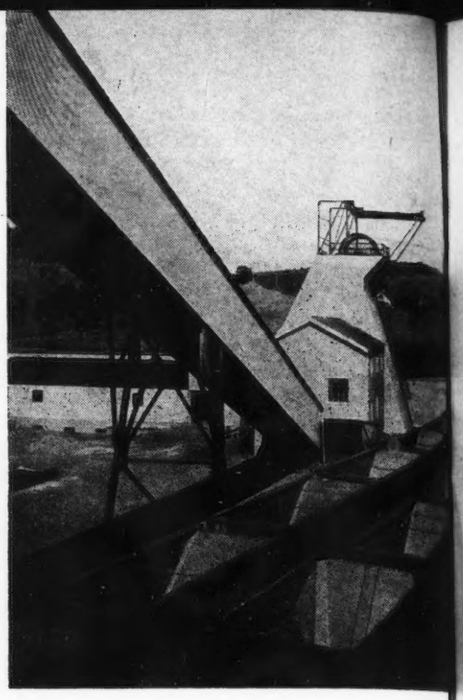
Public Thinking Improves —Takes Note of Future

The Minnesota Iron Country public, once spectacularly reckless in spending the money derived from taxes and seemingly oblivious to any idea that the iron ore would not last forever, is today in the process of slowly mending its ways. A per-capita limit, which nevertheless is still generous, has been imposed by law on the expenditures made by the mining communities in the state, and an awareness of the iron-ore operator's problems appears to be growing in the legislative halls at St. Paul, where the state laws are framed.

Thought is being given, moreover, to the possibilities of diversifying local industry, so that range communities may continue to live should the day come when ore shipments dwindle—a reasonable precaution. Already with state money the difficult problem is being attacked of finding a way to utilize the truly enormous reserve of peat that exists in the northern counties, and a state-financed experimental project is under way on the eastern Mesabi for making iron powder of high purity from low-grade iron carbonate material, with the ultimate objective of producing metal parts. These projects are indicative of the awakening of the public and the authorities to the need for doing something to safeguard the future and if possible to improve it. They need not be regarded, however, as symptoms of alarm. Perhaps this new trend in public thinking may lead to an easing of the tax burden on the operators.

The Industry Looks Ahead

The iron-mining industry's concern for the future has been indicated in three ways: in the interest it has displayed in possible new sources of iron ore here and abroad; in making radical changes to lower its mining costs; and in its increasing attention to beneficiation. The inroads on reserves by World War II have intensified this interest. At last, ambitious ore-treatment programs are being laid down to be carried out in laboratories that are well staffed and equipped—the culmination of more than three decades of work in research and development by a relatively small group of workers, whose efforts have scored repeatedly.



EMPTIES at Brotherton shaft, Sunday Lake mine (Pickands, Mather & Co.), Wakefield, Mich., on Gogebic Range.

Through this long period the tonnage beneficiated (including ores merely crushed and screened) has steadily grown. In terms of percentage of annual shipments, it has increased from 14.20 in 1921 to 43.63 in 1939. From 1941 up to the present, however, ores merely crushed and screened were not recorded as beneficiated, in consequence of which the percentage of shipments counted as beneficiated in 1945 was 20.77.

Back of these facts is the circumstance that today 38 percent of the Minnesota iron mines have a plant for ore treatment of some kind, ranging from simple screening to washing, concentration, and sintering in varying combinations, the prime objective in all save the last being to lower the silica and raise the iron content. In Michigan, in contrast, where mining is almost wholly underground and costs and competition do not permit an added charge for beneficiation, there is but one ore-treatment plant, which, it so happens, was installed in 1945.

How Research Has Grown

The following facts will round out the up-to-date picture in respect to research: Augmenting the facilities previously existing in the Iron Country, two large laboratories and test plants equipped for general ore-dressing research, and a commercial laboratory specializing in flotation, have been put in commission in the past two years, one of them only recently. In addition, the state of Minnesota will soon install a new laboratory on the Mesabi and a prominent operator is organizing a research staff and planning a large laboratory on one of the Michigan ranges for general work. A program sponsored jointly by 10 iron-mining operators is moreover under way. Thus, outstanding results in beneficiation may be expected. A freer exchange of information than now exists would help the industry.

Taconite for Iron

Research, it is reported, has given a sure answer to the problem of extracting the iron from taconite, the low-grade formation which is said to be the source of the iron in Mesabi ores and those of other ranges and which is available today in huge tonnages. As the ores now mined approach exhaustion, the deficiency can be made up by building huge plants to recover the iron in the taconite, or so the advocates of such procedure claim. What Nature did eons ago by natural processes, the industry, they propose, will do mechanically and, ton for ton, much faster, though at great outlay of money for plant and equipment.

An ambitious enterprise, projected to recover the iron from taconite occurring on the east end of the Mesabi Range, was established in the 'twenties and failed, perhaps because it was too early. Similar projects are again afoot. Much persuasive publicity has been given the subject. At least one important operator, after long research, is definitely planning to be producing merchantable taconite concentrate within two years. The plant will gradually be expanded in size and multiplied in number until the project is yielding several million tons of shipping product yearly. Successful concentration is said to be assured, and it is believed that the cost per unit can be lowered with equal success as tonnage is increased. Thus the day of taconite utilization appears to be close at hand.

As intimated, a great investment will be required. Figures vary with the individual citing them, ranging from $5 upwards per ton of annual capacity of finished product; that is, at least $5,000,000 for a million-ton plant. The picture of a Mesabi having many such plants is most intriguing.

Underground Mines Present a Problem

Half of Minnesota's remaining iron reserves, it is said, will have to be mined by underground methods;[1] likewise, most of the ore on the Michigan ranges. This dictum, if correct, presents a problem, inasmuch as underground ore in general costs more to mine than open-pit ore because of the greater amount of labor required per ton, yet must be sold in competition with corresponding grades produced in the pits. This competitive position was worsened for the underground mines by the horizontal wage increases granted. The underground miner can find a solution only by reducing the operating cost per ton, as by changing the mining method and otherwise improving efficiency; also by improving the equipment and mechanizing to a greater extent, if possible. Other important cost items, such as royalty, freight, and taxes, are not subject to the operator's control and are not likely to be cut save as their maintenance unchanged tends to decrease their respective yields.

This problem is being studied. A cheaper method than top-slicing, which is used in many Iron Country mines, appears to be needed. Lower-cost substitutes considered include block-caving and sublevel caving, the latter of which is regarded as the more promising. One Minnesota mine, which has been selected for experimental purposes, is being converted, rather easily it seems, from top-slicing to sublevel caving. At the same time shaker conveyors are being included in the test.

Shaker conveyors, having been found advantageous in top-slicing in one of the Mesabi mines, have found further favor in Michigan, where on the Menominee Range three mines are using them. In one of these, which was opened a few years ago from grass roots, the newest level is being equipped with belt conveyors fed by shakers instead of with the usual electrified main haulage system, suggestive of a possible new trend in mining. At two neighboring mines also shaker conveyors have been installed, serving in one to convey fill to the point of disposal from a 36-in. borehole from surface.

[1] See "Underground Lake Ore Costs Must Come Down," by J. Fred Wolff. E.&M.J., March 1946.

Trends and Innovations

To date the Iron Country can exhibit two shafts that have been created by enlarging shot-drilled boreholes of 5½-ft. diameter. Similarly, it can show at least two large holes made by reaming smaller churn-drill holes, one of which has just been mentioned. With such a start one may expect to see the number of such instances grow, in view of the advantages of the practice in relation to underground development or in permitting convenient access to distant workings of a mine.

Great activity in exploratory diamond drilling is a current feature. This is marked by efforts to increase core recovery by improving equipment design and drilling technique. An increasing tendency to wedge off new holes from an intermediate point on the hole first drilled is noted.

In open-pit practice a novel feature will be the use of a walking dragline of 25-cu.yd. bucket capacity for stripping, which will deliver to a conveyor system for disposing of the overburden. The trend is toward bigger trucks, moreover, for handling ore—up to 35 and 40 tons' capacity, though most of the units in the fleets of the companies using them remain at 15 tons.

"Fusion-piercing" of blast holes for use in very hard ground where the usual drilling methods can give only a relatively slow rate of advance is now under field test on the eastern Mesabi, as announced on page 63 of this issue. By this method the rock is actually smelted downward rapidly to give the hole.

In beneficiation, an outstanding development is the replacement of the cone in sink-and-float practice with a modified spiral classifier, the separation being done in the tank.

During the war years on the Lake Superior ranges emphasis was placed on getting out the tonnage. With the pressure less, the future should witness interesting developments in mining and beneficiation beyond those recounted here.

Useful Block Diagrams Are Easy to Construct

A. T. BRODERICK, Mining Geologist, Calumet, Mich.

THE GEOLOGIST OR ENGINEER who wishes to make a block diagram from a plan map will find the systems described here faster than the tedious divider or scale methods of transferring points that are usually used. The necessary materials can be found in most engineering offices, and the accuracy of the finished projections depends only on the mechanical perfection of their assembly. A few of the common types of projection are illustrated here. By changing the angles between the component parts of the apparatus, or by using plans of different scales instead of the same scale, or by changing the vertical scale, or by a combination of all three, many variations from these types can be obtained.

Isometric Projection. Two thin steel straightedges are fastened to the drawing board so that they include an angle of 120 deg. See Fig. 1. Two strips of celluloid are then laid across and parallel to them. These strips are then fastened in this position to two triangles, each of which has one edge against one of the straightedges. This results in an assembly by which lines can be drawn parallel to the left-hand straightedge by holding the right-hand triangle tightly against the right-hand straightedge, and vice versa.

Two copies of the plan to be projected are needed and are mounted on the two sides of the apparatus as shown in Fig. 2. Note particularly that the edge of the left-hand triangle lies parallel to the north-south direction on the left plan, and the edge of the right-hand triangle lies parallel to the east-west direction on the right plan.

With this arrangement, the projection of any point on the plan can be found at the intersection of the celluloid strips when the two triangles edges are on the point in both plans. After the top level or contour line has thus been completed point by point, the projection sheet is slid upwards parallel to the vertical axis of the finished drawing a distance equal to the difference in elevation at the scale used, and the details at the new elevation are then projected in the same manner. Fig. 3 shows the projection of a point *P* from the two plans to the bottom face of the block. The lower edges of the strips are used here in locating points and drawing lines. Some may prefer to use the upper edges.

Oblique Projection. By placing the left-hand straightedge in a horizontal position, setting the angle between the two straightedges at 135 deg., changing the triangle-strip connections correspondingly and using two plans, the right one of which is one-half the scale of the other, the variety of the oblique known as the "cabinet projection" is produced. In this projection, the front-to-back dimensions are foreshortened by one-half. The same result is obtained by using two plans of the same scale if the angle between the straightedges and the one between the left-hand triangle and its strip are changed to 159 deg. 20 min. The angle between the left-hand triangle and its strip is left at 135 deg. as before. Fig. 4 shows the top level of a cabinet block being projected from two plans of different scales while the bottom is being projected from two plans of the same scale. Ordinarily changes in elevation are made by moving the projection sheet up or down as in Fig. 3 rather than by moving the two plans as is shown in Fig. 4.

One-Point Perspective. A diagram of this type is obtained by pivoting one of the triangle-strip connections and supplying a thumb-tack vanishing point along which the lower edge of the strip slides as shown in Fig. 5. For the sake of clarity in Figs. 5 and 6, the pivot is shown at the corner of the triangle. Actually, it may be constructed any place on the triangle. Note that the straightedge associated with the pivoted triangle-strip connection and the other strip are parallel and horizontal. The angle "X," which determines the amount of foreshortening, is chosen arbitrarily to give the shape of block desired. Since the distance *AB* in the projection changes from level to level (*A'B'* is greater than *AB*) the angle *X* must be varied correspondingly (*X'* is greater than *X*). Notwithstanding the fact that equal distances on the plan parallel to the direction of *AB* do not become shorter toward the back of the block as they should in true perspective, the resulting diagram is entirely satisfactory for most purposes. Changes in elevation of projection can be accomplished either by moving the two plans downward and adjusting the angle *X* as is shown in Fig. 5 or by moving the projection sheet and the vanishing point upward and then changing the angle *X*. The position of the vanishing point relative to the pivoted triangle's straightedge determines the angle of vision and can be changed so as to show relatively more or less side, top, or end.

Two-Point Perspective. By pivoting both triangle-strip connections, supplying two thumb-tack vanishing points, and mounting both plans along the same straightedge, a block in two-point perspective can be drawn (Fig. 6). Note that the straightedge and a line drawn through the vanishing points are parallel and horizontal. In this projection, equal distances on the plans do decrease in length toward the back of the block and so satisfy the requirements of perspective. Changes in elevation of projection are produced by moving the plans, triangles, and straightedge down or by moving the projection sheet and the vanishing points upward. The shape, size, and proportions of the finished block depend on the distance between the vanishing points and the position of the plans relative to them and to each other.

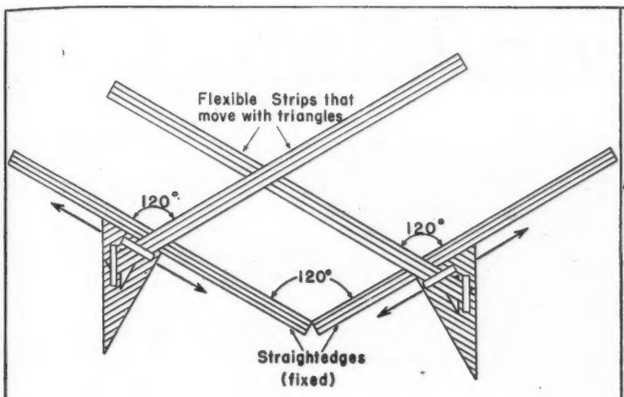


FIG. 1.

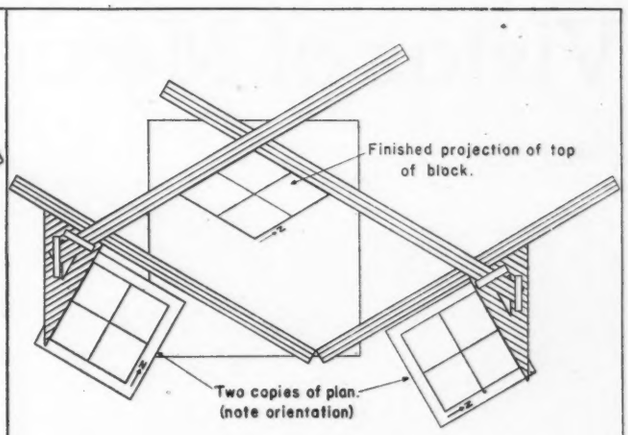


FIG. 2.

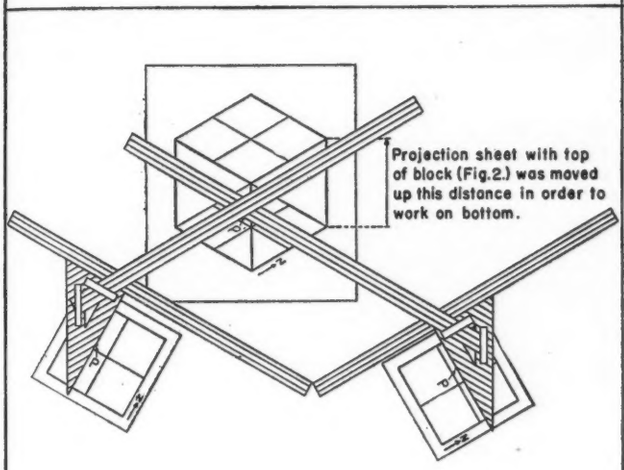


FIG. 3.

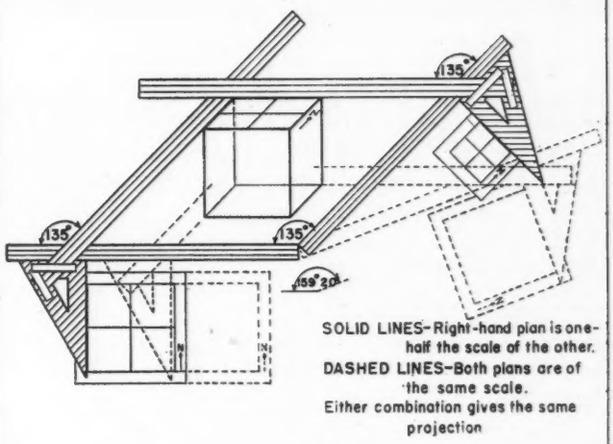

135°
135°
135°
SOLID LINES–Right-hand plan is one-half the scale of the other.
DASHED LINES–Both plans are of the same scale.
Either combination gives the same projection

FIG. 4.

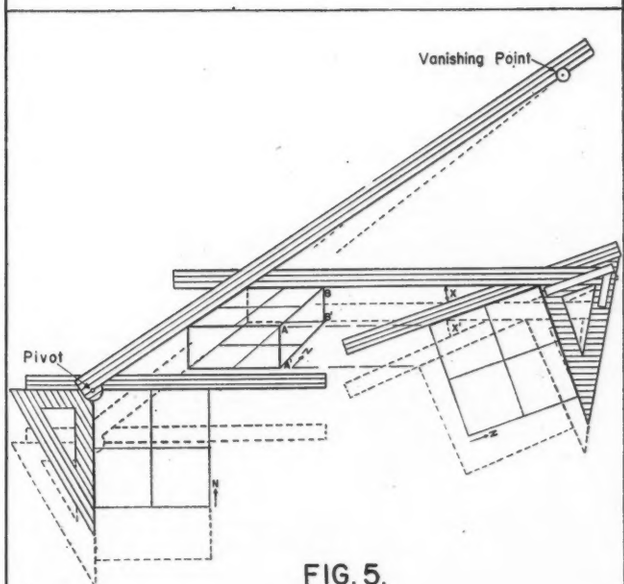


FIG. 5.

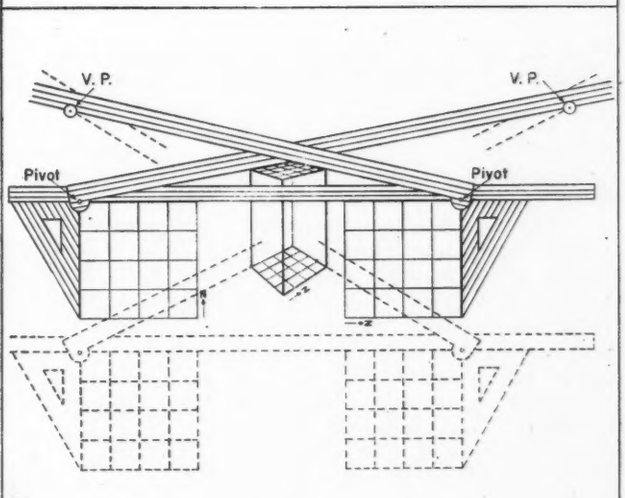


FIG. 6.

PROGRESSIVE STEPS in making an isometric block diagram are shown in Fig. 1, 2, and 3. Fig. 4. Shows method of constructing oblique block diagrams including those involving cabinet projection. One-point and two-point perspective methods are demonstrated in Fig. 5 and Fig. 6, respectively. By shifting plans laterally in Fig. 6, the shape of the diagram may be changed.

Vistas of Mexican Mining—II

EVAN JUST, Editor

Several Mines at Santa Barbara

SCATTERED over the beautiful hillsides of southern Chihuahua, about 18 miles west of Parral, the American Smelting & Refining Co. operates a number of mining properties, including Tecolotes, Alfarena, Hidalgo, Los Angeles, Palo Blanco, Mina del Agua, Coyote, Segovidad, and Cobriza. The ore from the several mines is moved by electric railroad and tramways to the Santa Barbara milling plant, which has a capacity of some 1,800 tons per day. The ores treated here by the company contain zinc, lead, copper, silver, and gold.

Improvements made at the mill in recent years include a modern storage patio and chemical mixing plant. The operation is well equipped with shop facilities. In the mines detachable bits and hot-milling are employed.

The Santa Barbara mill was the first commercial successful flotation plant in the Western Hemisphere. Using the Elmore patents, a flotation plant was built in 1908, which has been in continuous operation ever since, having been enlarged and modernized from time to time.

[1] For a complete description of this operation, see E.&M.J., March 1936, pp. 132-136, "Santa Barbara Camp Continues Active," by A. H. Hubbell.

San Francisco del Oro—A British Enterprise

OVER THE HILL from Santa Barbara lies San Francisco del Oro, where San Francisco Mines of Mexico, Ltd., a British organization, operates two mines. The larger, the Frisco, is 1,700 ft. deep. The smaller, the Clarines, is over the divide toward Santa Barbara. Ore from both mines is brought to the mill by aerial tram. Clarines is a cut-and-fill operation; Frisco a shrinkage. The latter accounts for 80 to 85 percent of the production[2].

The mill, a flotation plant, treats 45,000 metric tons of ore per month. The metallurgical job done by the mill is summarized in the accompanying table, pertaining to the last fiscal year.

Analyses of Ore and Mill Products, San Francisco Mill

	Gold, Gr./Ton	Silver, Gr./Ton	Lead, %	Zinc, %	Copper, %
Heads	0.9	176	6.8	9.4	0.8
Copper concentrate	2.7	1069	6.9	6.3	25.2
Lead concentrate	4.5	1240	61.0	9.9	1.9
Zinc concentrate	1.0	175	2.0	55.1	1.0
Tails	0.4	22	0.7	2.1 (a)	0.1

(a) The large zinc loss is due to the effort necessary to hold up the grade of zinc concentrates, that being essential to make the marmatitic concentrates marketable.

It was in this plant that a process was developed for separating copper from lead concentrate by treatment with sulphurous acid (pH of 3) to activate chalcopyrite, then neutralizing with lime (pH of 6.5), and floating off the chalcopyrite. The lead concentrate subjected to this treatment is 50 percent lead, 6 percent copper, and 12 percent zinc. After flotation the lead concentrate is given a final cleaning on tables. This copper-separation treatment is not given to a lead concentrate made by tabling the primary rod-mill discharge, as this concentrate contains only 0.5 percent copper.

[2] For a special issue devoted to San Francisco Mines of Mexico, see the August 1936 issue of E.&M.J., containing several articles on various phases of the operation.

PANORAMA of Santa Barbara. Left to right, town, mill, colony, and tailings pile.

AERIAL VIEW of San Francisco del Oro. Frisco mine, top center; mill, center; tailings pile, lower center; and colony, right center.

Parral—Big and Progressive

THE PARRAL MINE of American Smelting & Refining Co. produces from three veins. The hoisting shaft is in the footwall of the large (up to 60 ft. thick) Prieta Tajo vein, which strikes northeast and dips 70 to 85 deg. southeast. At the northeast end is the Europa vein, probably the faulted-off continuation. The Iguana vein, a half mile to the southeast of the hill on which the mill and headframe sit, overlooking the town, is connected underground. Parral's deepest level is now at 1,800 feet[3].

The country rock is Tertiary andesite. The ore is galena, marmatite, and chalcopyrite containing some silver and gold, in a gangue of quartz, with calcite, barite, and fluorite.

Cut-and-fill stoping is used mainly in the wider sections where walls stand poorly. Other parts of the mine are worked by shrinkage stoping. A limited amount (5 percent of production) of square-set cut-and-fill is used where the back is unsafe for ordinary cut-and-fill. The cut-and-fill practice has been modified in recent years to dispense with flooring, it having been found that the waste packs hard when wet down. The ore is scraped along a 10- to 20-deg. slope to timbered raises which connect by finger to footwall raises. The coarser ore is broken at the tops of these timbered raises, so that the need for a grizzly level is eliminated.

Much of the back comes down naturally. This is encouraged to a certain extent to save primary blasting, two or three cuts up to 12 ft. each often being made above the back of the silled-out vein without waste-filling, before starting cut-and-fill mining. This is commonly referred to as semi-shrinkage work.

The mill, which is of 1,800 tons' total capacity, is a modern, well-kept flotation plant. It includes a cyanide plant, which is shut down at present. In due course it will be reopened, to handle some siliceous and carbonate ore still remaining in the mine. When this plant was last operated, all the ore was subjected to flotation, the flotation tails from one section of the mill being cyanided.

In the flotation plant only lead and zinc concentrates are made at present. At times, however, some copper concentrates are made. Copper goes with the lead when not separated. The zinc concentrates are de-leaded by depressing the zinc with cyanide and buffering with zinc sulphate.

The Parral mine is well equipped with welding, machine, drill, and bit shops. Detachable bits are used, which are hot-milled. All employees exposed to dust are given aluminum prophylaxis in the change houses. Aluminum treatments are also given to silicotics.

[3] For a complete description of this property see E.&M.J., March 1936, pp. 127-131, "Parral's Output Mostly from Cerro de la Cruz," by A. H. Hubbell.

AERIAL VIEW OF THE PARRAL UNITS. Bottom to top: principal manway and service (Prieta) shaft, drill shop, bit shop, and change house; office; principal ore-hoisting (Aguilerena) shaft; machine shop; foundry and welding shop; crushing plant (left of machine shop); grinding and flotation plant; colony; and tailings pile. Cyanide plant to right of flotation plant over hill, glory holes for fill on right. Town of Parral is seen in lower right and left of the photograph.

MARKET SUMMARY

DESPITE FALLING SECURITY VALUES in Wall Street, and widespread shipping difficulties caused by labor disturbances, demand for major non-ferrous metals throughout September continued at record peacetime levels. The price situation remained strong and was reflected in higher quotations in free markets outside of the United States. In copper, foreign buyers paid as high as 17c., f.a.s. New York equivalent. Both lead and zinc brought 10¼c. in foreign transactions. The rise in prices abroad is expected to stimulate production.

The price situation in the United States remained about unchanged. Though it was reported unofficially that OPA had reached an agreement on the extent of the rise in the ceiling price of zinc that will come sooner or later, no action was taken during the month to relieve buyers and sellers from continued price uncertainty. In reference to copper, scrap dealers were told that, as in lead, they should not expect an upward revision in the ceiling price "in the foreseeable future." As September ended, refiners of copper were in the dark on the extent of the rise that OPA is to allow on premiums for special shapes.

Copper statistics for August showed a further gain in output of both crude and refined, due to the resumption of work at mines and refineries. Production of crude amounted to 64,209 tons in August, against 56,906 tons in July and 32,785 tons in June, Copper Institute reports. Output of refined copper in August was 59,591 tons, against 43,606 tons in July and 23,870 tons in June. Deliveries of refined copper to consumers increased from 96,826 tons in July to 118,814 tons in August. As for some time past the Government released a large tonnage to consumers. Metals Reserve had 232,613 tons of copper on hand at the end of August, against 264,849 tons a month previous. Included in the total is copper still in process.

Foreign buyers purchased copper at rising prices because they feared that the supply situation may not improve much before the second quarter of next year. Copper needs abroad are heavy. The British Government paid the equivalent of 16½c. for Rhodesian copper, purchasing 9,000 tons. The RFC bought 40,000 tons of foreign copper for last-quarter delivery. Strikes and the threat of strikes have re-

Major Metals

U.S. DAILY AND AVERAGE PRICES

1946 Sept.	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: East St. Louis
2	Holiday	16.300	Holiday	Holiday	Holiday	Holiday
3	14.150	16.300	52.000	8.25	8.10	8.25
4	14.150	16.350	52.000	8.25	8.10	8.25
5	14.150	16.300	52.000	8.25	8.10	8.25
6	14.150	16.350	52.000	8.25	8.10	8.25
7	14.150	16.350	52.000	8.25	8.10	8.25
9	14.150	16.350	52.000	8.25	8.10	8.25
10	14.150	16.350	52.000	8.25	8.10	8.25
11	14.150	16.425	52.000	8.25	8.10	8.25
12	14.150	16.250	52.000	8.25	8.10	8.25
13	14.150	16.400	52.000	8.25	8.10	8.25
14	14.150	16.425	52.000	8.25	8.10	8.25
16	14.150	16.425	52.000	8.25	8.10	8.25
17	14.150	16.425	52.000	8.25	8.10	8.25
18	14.150	16.500	52.000	8.25	8.10	8.25
19	14.150	16.550	52.000	8.25	8.10	8.25
20	14.150	16.550	52.000	8.25	8.10	8.25
21	14.150	16.450	52.000	8.25	8.10	8.25
23	14.150	16.525	52.000	8.25	8.10	8.25
24	14.150	16.675	52.000	8.25	8.10	8.25
25	14.150	16.825	52.000	8.25	8.10	8.25
26	14.150	16.800	52.000	8.25	8.10	8.25
27	14.150	16.825	52.000	8.25	8.10	8.25
28	14.150	16.675	52.000	8.25	8.10	8.25
30	14.150	16.775	52.000	8.25	8.10	8.25
AVERAGES FOR MONTH						
Sept.	14.150	16.486	52.000	8.25	8.10	8.25
AVERAGES FOR WEEK						
4	14.150	16.288	52.000	8.25	8.10	8.25
11	14.150	16.354	52.000	8.25	8.10	8.25
18	14.150	16.404	52.000	8.25	8.10	8.25
25	14.150	16.596	52.000	8.25	8.10	8.25
CALENDAR WEEK AVERAGES						
Sept. 7	14.150	16.325	52.000	8.25	8.10	8.25
14	14.150	16.367	52.000	8.25	8.10	8.25
21	14.150	16.483	52.000	8.25	8.10	8.25
28	14.150	16.721	52.000	8.25	8.10	8.25

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Effective March 14, our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead are for common lead.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

1946 Sept.	Sterling Exchange: (c) "Checks"	Silver: New York	Silver: London	Gold: London	Gold: (d) United States
2	Holiday	Holiday	55½d.	172s. 3d.	Holiday
3	403.250	90.125	55½d.	172s. 3d.	$35.000
4	403.250	90.125	55½d.	172s. 3d.	35.000
5	403.250	90.125	55½d.	172s. 3d.	35.000
6	403.250	90.125	55½d.	172s. 3d.	35.000
7	(e)	(e)	(e)	(e)	35.000
9	403.250	90.125	55½d.	172s. 3d.	35.000
10	403.250	90.125	55½d.	172s. 3d.	35.000
11	403.250	90.125	55½d.	172s. 3d.	35.000
12	403.250	90.125	55½d.	172s. 3d.	35.000
13	403.250	90.125	55½d.	172s. 3d.	35.000
14	(e)	(e)	(e)	(e)	35.000
16	403.000	90.125	55½d.	172s. 3d.	35.000
17	403.000	90.125	55½d.	172s. 3d.	35.000
18	403.000	90.125	55½d.	172s. 3d.	35.000
19	403.000	90.125	55½d.	172s. 3d.	35.000
20	403.000	90.125	55½d.	172s. 3d.	35.000
21	(e)	(e)	(e)	(e)	35.000
23	403.000	90.125	55½d.	172s. 3d.	35.000
24	403.000	90.125	55½d.	172s. 3d.	35.000
25	403.000	90.125	55½d.	172s. 3d.	35.000
26	403.000	90.125	55½d.	172s. 3d.	35.000
27	403.000	90.125	55½d.	172s. 3d.	35.000
28	(e)	(e)	(e)	(e)	35.000
30	403.000	90.125	55½d.	172s. 3d.	35.000
AVERAGES FOR MONTH					
Sept.	403.113	90.125	55½d.	—	35.000
AVERAGES FOR WEEK					
4	403.250	90.125	—	—	—
11	403.250	90.125	—	—	—
18	403.100	90.125	—	—	—
25	403.000	90.125	—	—	—

Calendar week averages, New York Silver: Sept. 7th, 90.125; 14th, 90.125; 21st, 90.125; 28th, 90.125.

(e) Not quoted (Saturday).

Quotations for foreign silver are for bar silver, in cents per troy ounce .999 fine, in amounts of 50,000 oz. or more, nearby delivery, New York. Price quoted is in cents and one-eighth cent fractions, and is usually about one-quarter cent below the market to allow for delivery, carrying, and marketing. In addition to foreign silver, the quotation also applies to domestic and Treasury silver if such silver enters into the market. The Treasury's purchase price of newly mined domestic silver 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

stricted production of copper abroad.

The RFC has purchased foreign lead for the fourth quarter on the basis of 10¼c. a pound. The ceiling here was maintained at 8¼c., New York, indicating to producers that OPA has failed to understand the relationship of price to demand and supply. Scrap receipts since July have dropped.

Zinc producers, convinced that a higher ceiling was in the making, limited sales to "price prevailing on date of shipment."

Silver was active. Taking advantage of the price situation, the British Government will withdraw its silver coins form circulation and substitute cupronickel. Supplies recovered are expected to be used to return metal obtained here under Lend-Lease.

Platinum was advanced to $90 an ounce troy, effective Sept. 16. Demand from the jewelry trade eased somewhat at the higher level.

Bolivian tin concentrate contracts were signed Sept. 13. The base price is 62½c., for tin contained, f.o.b. South American ports, with premiums of 1 to 3c. if production requirements are met.

Miscellaneous Metals Monthly Averages

Average prices of miscellaneous metals for August and September:

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

	Aug.	Sept.
Quicksilver, N. Y. flask	97.556	96.000
Antimony (a)	15.839	15.839
Antimony, bulk, Laredo	14.500	14.500
Antimony, bulk, N. Y.	15.265	15.265
Antimony, Chinese (b)	16.500	16.500
Platinum, oz. troy	78.556	85.417
Cadmium (c)	125.000	125.000
Cadmium (d)	127.500	127.500
Cadmium (e)	130.000	130.000
Aluminum ingot	15.000	15.000

E & M J Price Index

Weighted index of non-ferrous metal prices (copper, lead, zinc, tin, silver, nickel, and aluminum). The average for the years 1922-1923-1924 equals 100.

1929	110.33	1937	90.86
1930	82.87	1938	73.67
1931	60.20	1939	77.71
1932	48.26	1940	79.22
1933	59.79	1941	83.49
1934	65.59	1942	86.80
1935	74.66	1943	88.74
1936	73.45	1944	88.74
		1945	90.86

	1944	1945	1946
January	88.74	88.74	96.42
February	88.74	88.74	96.42
March	88.74	88.74	96.42
April	88.74	88.74	96.42
May	88.74	88.74	96.42
June	88.74	88.74	107.16
July	88.74	88.74	117.11
August	88.74	88.74	113.32
September	88.74	91.16	113.32
October	88.74	96.40	....
November	88.74	96.42	....
December	88.74	96.42	....

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

MISCELLANEOUS METALS

(September 30, 1946)

Aluminum, ingot, 99 plus percent, lb.	15c.
Antimony, domestic, spot, lb., 5 tons or more	15.839c.
Bismuth, ton lots, lb.	$1.60
Cadmium, commercial sticks, lb.	$1.25
Calcium, lb. ton lots, 97 @ 98 percent, cast	$1.85
Chromium, 97 percent grade, lb.	89c.
Cobalt, 97 to 99 percent, per lb.	$1.50
Indium, troy oz.	$2.25
Nickel, electrolytic cathodes, lb.	35c.
Magnesium, 99.8 percent, carloads, lb.	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$90.00
Quicksilver, flask of 76 lb., 25 flasks or more	$96.00
Selenium, 99.5 percent, lb.	$1.75
Silicon, minimum 97 percent, spot, carloads, lb.	14.75c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$17.50
Titanium, 96 to 98 percent, lb.	$5.00

METALLIC ORES

Beryllium Ore, 8 to 12% BeO, f.o.b. mine, per unit	$8.00@$10.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio (Prices nominal)	$41.00
48% Cr_2O_3, 3 to 1 ratio	$43.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$5.45
Mesabi bessemer	$5.20
Old Range non-bessemer	$5.30
Mesabi, non-bessemer	$5.05
Lead (Galena) 80 percent, Joplin, Mo., ton	$99.90
Manganese, Metals Reserve Co. sales price, per long-ton unit of Mn contained, 48 percent, subject to premiums and penalties, effective May 15, 1944: 85c. (duty paid) New York, Philadelphia, Baltimore, Norfolk, Mobile, and New Orleans; 91c., Fontana, Calif., Provo, Utah, and Pueblo, Colo. (Current prices in open market nominal at 73@75c. per long-ton unit.)	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Foreign, 60 percent, duty paid	$22.00
Domestic, scheelite, 60 percent and upward	$24.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$50.00

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl., carload lots	5c.
Cobalt Oxide, 70 to 71 percent, lb.	$1.06
Copper Sulphate, 100 lb.	$5.65

ALLOYS

Beryllium Copper, 2.5 to 3 percent Be, per lb. of contained Be	$14.75
Ferrochrome, 65 to 70 percent per lb. of Cr contained	13c.
Ferromanganese, 78 to 82 percent, gross ton	$135.00
Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo contained	95c.
Ferrosilicon, 50 percent, per lb. of contained Si	6.60@8.10c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$1.90
Ferrovanadium, per lb. of V delivered	$2.70@$2.90
Silicomanganese, 1 percent C, gross ton	$138.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U.S funds), ton:	
Crude No. 1	$650@$758
Crude No. 2	$165@$385
Spinning fibers	$124@$233
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.00
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$8.50@$9.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$8.25@$8.50
Bauxite, long ton:	
Domestic, crude, 50 to 52 percent (not dried)	$5.00
Domestic, chemical, 55 to 58 percent	$7.50@$8.50
Domestic, abrasive, 80 to 84 percent	$16.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$15.00
Feldspar, bulk ton:	
Potash feldspar, 200 mesh	$17.00
Glass spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 60 percent, all rail movement, ton	$30.00
Acid 98 and 1 percent, bulk, ton	$37.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington	$22.00
Mica: Domestic producers quote on punch and sheet as follows: Punch, 22c. per pound; 1½x2 inch, $1.10; 2x2 inch, $1.60; 2x3 inch, $2.10; 3x3 inch, $2.75; 3x4 inch, $3.50; 3x5 inch, $4; 4x6 inch, $5. Wet ground, very fine, $90 per ton. Special grades command premium. Bulk sales dry ground, $32.50 per ton. Scrap, $28 per ton and up.	
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c i f. Atlantic ports	12c. nom.
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
Vermont, extra white, 200 mesh	$9.50@$10.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$28.00
Steel, base price, Pittsburgh Billets, gross ton	$39.00
Structural shapes, 100 lb.	$2.35

WASHINGTON REFLECTIONS

McGRAW-HILL WASHINGTON NEWS BUREAU

Munitions Board Plans Stockpile Purchases

High military and civilian planners in Washington, believing that a definite industrial mobilization plan is a deterrent to war, are well into a program to keep industry prepared for a rapid changeover in an emergency.

Richard R. Deupree, executive chairman of the Army and Navy Munitions Board, pointed out recently that a skeleton outline of the complete industrialization plan has been developed. "It is just about impossible to say how far advanced the mobilization plan is, but it is very definitely in the making, and its conception today is rather clear, although a tremendous amount of work must be done to bring forth a finished document," he said.

The Army-Navy Munitions Board, believing that a War Production Board will be necessary to effective industrial mobilization in any future emergency, has authorized a group of civilians who had experience in WPB in the last war to develop a manual which will outline the organizational structure dictated by experience.

"As of now, the Board has formalized the stockpiling objectives, year by year, as to composition and requirement, and has determined and directed the purchase of the first year's increment after clearance by the Departments of State, Interior, Commerce, and Agriculture, and the Civilian Production Administration. The board is now developing a supplemental list of items for additional purchase in fiscal 1947 for presentation to Congress," said Mr. Deupree, adding that the board intends to avoid impeding industry reconversion by its purchases.

Government Agencies Must Rationalize Regulations

The first move of the more than 150 Governmental agencies in Washington to conform with the recently enacted McCarran-Sumners Administrative Procedure Act was to issue a detailed statement of their organization and rules in a 1,000-page edition of the Federal Register on Sept. 11.

The new act forces the bureaus to dispel the smoke-screen covering their activities and powers and to abide by established legal procedures.

All of the reforms set up in the Act must be in effect by June 11, 1947.

The most important function of the Act is to strip the regulatory agencies of their power to make arbitrary decisions which cannot be reversed in court. The Act does this by altering the Supreme Court's stipulation that the lower Federal courts must limit their review of agency actions to Constitutional and statutory questions. This change gives the lower courts the opportunity to pass on evidence.

The old "drumhead court" procedure of one Government official acting as judge, jury, and prosecutor in a hearing is out under the new law. Further, any person called before a hearing by any agency may now be allowed counsel. Any agency holding a hearing must inform persons concerned of the time and place, the charge, and the regulation or law that calls for the hearing, and in time enough to prepare their cases.

Gold Value of Dollar to Continue at $35 an Ounce

The par value of the American dollar will remain at $35 per ounce of gold, the Secretary of the Treasury, John W. Snyder, has informed the International Monetary Fund. The announcement was made shortly after Hugh Dalton, British Chancellor of the Exchequer, declared that the sterling-dollar exchange rate would remain unchanged.

Secretary Snyder released the text of a letter to Camille Gutt, managing director of the International Monetary Fund, quotations from which follow:

"In reply to your letter of Sept. 12, 1946, which was received the same day, I have the honor, on behalf of the United States Government, to inform the International Monetary Fund that the par value of the dollar is fifteen and five-twenty-firsts (15 5/21) grains of gold nine-tenths (9/10) fine.

"The United States Government desires that the par value here communicated shall be the par value of the dollar for the purposes of the Fund as mentioned in Article XX. This par value of the dollar is hereby communicated to the Fund for all territories and possessions of the United States."

U. S. Participates in Tin Cartel Conference

The United States, anxious to have a voice in the British-Dutch-Belgian-Bolivian control of tin, has sent a delegation to attend a world tin conference in London Oct. 8 to 12.

Donald B. Kennedy, chief of the Division of International Resources of the State Department, is the American delegate. Assisting him are the following advisers: John Croston, deputy director for metals and minerals, of CPA; Jesse C. Johnson, deputy director for metals of RFC; Elmer Pehrson, chief of the economics branch, Bureau of Mines; Samuel Lipkowitz, chief of the minerals section of the international resources division of the State Department; and Carl Inglefritz, vice president of the Carnegie-Illinois Steel Corporation.

Premium Plan Regulations Are Liberalized by OWMR

Complying with the Price Control Extension Act of 1946, that makes mandatory certain changes in existing practices with regard to allowances in quotas for exploration, development work, depreciation, and depletion, in mid-September John R. Steelman, Director of Economic Stabilization, issued Directive 137. In effect, the revised regulations will increase subsidy payments to copper, lead, and zinc mines to encourage exploration, providing there is reasonable expectation of production by Dec. 31, 1947.

Under this action, mines producing less than 600 tons of copper, lead, and/or zinc in the twelve months ended June 30, 1946, are eligible for an exploration premium of 1c. a pound of metal produced up to a limit of $1,000 a month per mine.

With reference to larger operators, exploration premiums will not be paid to mines which earn adequate margins without other premiums. Exploration premiums shall be assigned only for specific projects, fully justified by detailed substantiating data. Exploration premiums, under the directive just issued, will not be considered as income. However, all exploration premiums should be spent currently, and any such premiums unspent on Dec. 31, 1947, shall be returned to the Reconstruction Finance Corporation.

Normal development is allowed as an operating cost in all Quota Committee calculations. To allowances now made for plant ownership in lieu of depreciation in the calculation of operating margins shall be added the following allowances for mine plant, unless such mine plant has been in large part amortized by premium payments: Complex ores, 10c. a ton of ore; simple lead and zinc ores, 7c. a ton; Tri-State type ores, 5c. a ton; copper ores, 0.1c. a pound of copper.

To the allowances now made for mine ownership in lieu of depletion (50 percent of the basic margin calculated for the mine), there shall be added 25 percent of the net smelter return for each metal, other than copper, lead, and zinc, contained in the product for which payment is made to the producer by the processing plant. This feature, long overdue, is to overcome what was in effect a penalty imposed on gold and silver producers (*E.&M.J.* March 1945, p. 70).

NEWS OF THE INDUSTRY

Denver Meeting of American Mining Congress Focuses Attention on Problems of Industry

Sessions Are Unusually Informative—Higher Gold Price Deemed Necessary—Views on Premiums Controversial—Krug Offers Mining Full Cooperation—New Mining and Milling Techniques Revealed

Approximately 2,000 members of the mining industry, and about 200 of the ladies accompanying them, attended the first postwar Metal Mining Convention and Exposition of the Western Division of the American Mining Congress, in the Denver City Auditorium, Sept. 9 to 12. The gathering was the first completely representative Western Division meeting since 1941, at San Francisco, although there was a war conference at Salt Lake City in 1942. Machinery and equipment manufacturers therefore had their first opportunity for display since 1941, and rose to the occasion splendidly, the officials of the Congress pronouncing the machinery and equipment exposition the best in the history of the Western Division. There were 89 separate displays, and much new equipment, and examples of advances in design made during the war, were displayed for the first time.

Eleven new members were elected to the Board of Governors, important policy declarations were made (see following page) and much pertinent information was acquired by convention delegates.

The general sessions opened with a discussion of "World Economic Problems of Copper, Lead, and Zinc," by James Douglas, Phelps Dodge Refining Corporation. Douglas pointed out that reasonable forecasts based on economic conditions are not now possible, because of arbitrary, unpredictable economic controls exercised by governments. Douglas made a strong plea for a return to free enterprise, and denounced the Premium Price Plan as a socialistic instrument.

Must Support Gold

Discussing "The Future of Gold," Donald H. McLaughlin, president of Homestake Mining Co., affirmed his faith in gold's long-term future, but deemed a price increase improbable so long as Government is trying to combat inflation. He believes that an increase in price seems inevitable if we continue to require a so-called favorable balance of trade. He urged movement of gold in international commerce, and domestic issuance of gold coins with a fixed gold content but no specific dollar value; and he pointed out that our vast investment in gold calls for support of its value, and emphasized the right of the gold miner to enjoy the full price of his product.

Speaking on "The Future of Silver," Senator Abe Murdock, of Utah, denounced the silversmith bloc as predatory and unscrupulous. He upheld the aims of the Silver Purchase Act and expressed the hope of boosting the domestic purchase price to $1.29 per ounce.

In the opinion of Henry B. Fernald, chairman of the American Mining Congress tax committee, we can meet the public debt if we are determined to do so. Discussing "Problems of Federal Mine Taxation," he pointed out that high tax rates do not produce maximum Government revenue, and that the possibilities are virtually exhausted of increasing revenue by added burdens on high-bracket incomes and on corporations. He demanded enactment of a tax system that will encourage enterprise, exploration, and development.

Addressing the group on "What Is Needed In a Sound Code of Labor Law," Senator Wayne Morse, of Oregon, advocated free collective bargaining as a bulkwark against State control. He upheld the guarantees of labor's rights under the Wagner Act, but urged that the rules should provide equal protection to both sides. He stressed the evils incident to work stoppages due to jurisdictional disputes and secondary boycotts, and opposed mandatory "cooling-off" periods. He called for sincere use of voluntary arbitration, non-participation by Government unless called on, and a Senate investigation of the causes of labor-employer discord.

Commenting on the same subject, R. H. Glover, Anaconda Copper Mining Co.; Donald Callahan, Callahan Consolidated Mines Co.; Charles R. Kuzell, Phelps Dodge Corporation; and Rolla D. Campbell, West Virginia attorney, denounced the biased provisions and administration of the Wagner Act as the principal source of labor strife, and demanded equal rights for employers, freedom of speech, freedom to work and to employ, denial of bargaining rights to violators of contracts, separation of the functions of prosecutor and judge, and non-unionization of supervisory personnel. Glover described the flagrant violation of contract by the Butte union in the strike last spring and the destructive tactics of Communists. Kuzell pointed out that collective bargaining no longer exists and presented a detailed proposed code of labor law. Callahan indorsed the *E.&M.J.* proposal for an employer association devoted to strengthening employers' bargaining procedures and establishing better labor relations.

Pride in Job Needful

Speaking on "Selling Mining to the Miner," Whiting Williams, labor-relations consultant, urged the same systematic analysis of labor psychology that is applied to instruments and methods of production. He emphasized the desire of all individuals to seek self-respect through pride in their jobs, and pointed out that failure

Britain to Demonetize Silver Coinage

Expectations that the British Government might abandon silver currency were realized on Sept. 26, when Hugh Dalton, Chancellor of the Exchequer, announced that the existing silver-bearing coins will be gradually replaced by cupro-nickel coinage. Appropriate legislation will be introduced upon reassembly of Parliament, it was stated. Besides the shilling, which now contains about four cents' worth of silver, coins affected are the sixpence, the florin (2s.), and the half crown (2s. 6d.).

The prevalent world shortage and high price of silver were cited as reasons for the coinage substitution in the Government's announcement. Closely related to the move, according to reports, is the necessity of repaying in kind more than 300 million ounces of silver obtained by Britain from the United States under Lend-Lease agreements. Substitution of copper-nickel for silver will enable the Government to accumulate this quantity without resort to open-market purchases, while offsetting the cost against profit realized on the new coinage.

India, in the face of the same problem, has already taken similar action by withdrawing from circulation silver coins of less than one rupee value (*E.&M.J.*, July 1946).

SAFE POWER

EXIDE POWER SPEEDS UP HAULAGE, CUTS COSTS

Exide-Ironclads are engineered and powered to safely meet the heavier haulage requirements of today's mine, quarry and tunnel operations. They have the ruggedness necessary to withstand the greater strain that increased tonnage demands. And they provide the safety that reduces mine hazards.

With Exide-Ironclads on your trammers, locomotives and shuttlecars, you can count on the *high power ability* that frequent "stop and go" service requires...a *high maintained voltage* throughout discharge...the *high capacity* that provides full shift availability and sustained speeds throughout the day. Exide-Ironclad construction is assurance of these dependable qualities PLUS safety, long-life and ease of maintenance.

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THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

of employers to cultivate these human traits exposes an industry to divisive union leadership. He recommended keeping employees informed of business objectives, problems, and products, making more use of commendations for work well done, and humanizing the contacts between employers and employees.

W. H. Cranmer, New Park Mining Co.; A. H. Bebee, Golden Cycle Corporation; S. S. Clarke, Eagle-Picher Mining & Smelting Corporation; S. H. Williston, Horse Heaven Mines, Inc., and F. O. Davis, Potash Company of America, participated in a discussion of incentive wage plans for greater efficiency. Cranmer advocated the fullest possible use of incentives on as close to an individual basis as possible. He urged making plans equitable, acceptable to union locals, and correlating with insurance, pension, and savings arrangements. Clarke also indorsed bonus payments and cited important gains in powder economy, output per man, and lessened absenteeism. Bebee described the split-check leasing system used at Cripple Creek, whereby the lessees obtain 49 percent of the net returns from the mill, 1 percent being reserved as the lessee's share of taxes. The company furnished supplies, surveying, and technical advice. Williston acknowledged the productivity gains from incentive systems but opposed them on the ground that benefits are of short-term duration and non-bonus employees become discontented. Davis pointed out that incentive plans freeze labor charges and are hard to reduce when economic conditions change. He said that a good plan should allow for adjustments based on efficiency gains through added investments.

Premium Price Plan

Describing "Administration of the Premium Price Plan," Jesse L. Maury, of OPA, listed the production obtained through it, the cost and alleged savings, and outlined administrative principles. He defended the handling of depletion and depreciation, which was criticized as departing from the legislative mandate to use established accounting practices. Criticism was also expressed over penalties assessed against silver producers. Maury conceded that silver had not been recognized and intimated that the new rules of procedure would assure a betterment in this regard.

Speaking on "Trade Agreements and the Good Neighbor Policy," Karl Anderson, of the State Department, emphasized the mining industry's stake in maximum trade and said that Government policy fosters economic liberalism and private enterprise. He advocated lower tariffs, and eliminations of quotas, preferences, exchange restrictions, and cartels. However, he intimated that in some circumstances cartels between governments might be acceptable.

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Discussing "Mineral Raw Materials for Future Security," Col. Omer O. Niergarth, Army and Navy Munitions Board, described the new stockpiling law and promised caution in making purchases to foster industrial stability.

E. R. Lovell, Calumet & Hecla Consolidated Copper Co.; Evan Just, Editor of *E.&M.J.*; Andrew Fletcher, St. Joseph Lead Co.; Henry L. Day, Tamarack & Custer Consolidated Mining Co.; O. W. Bilharz, Bilharz Mining Co.; W. C. Page, U. S. Smelting, Refining & Mining Co.; S. H. Williston, Horse Heaven Mines, Inc.; Blair Burwell, U. S. Vanadium Corporation; and James P. Bradley, Bradley Mining Co., participated in a discussion of industry attitude toward subsidies, the tariff, and stockpiling. With reference to Michigan copper producers, Lovell indorsed a 4c. tariff and continued premium payments under a simplified plan. Just generalized the attitude of ten other leading copper producers, saying that the area of possible compromise was for a tariff of 2c. to 4c. without premiums or quotas. Fletcher blamed unrealistic Government control for shortages of lead and urged decontrol, or at least a price equal to the foreign level. He demanded uniform subsidy treatment within mining districts. Day was against subsidies, and prices below those abroad. He described the Premium Price Plan as discouraging to maximum production and development, and expressed fear that the present situation indicates the existence of a sinister socialistic plan.

Permanent Premium System

Speaking for Tri-State zinc-lead producers, Bilharz indorsed a permanent premium system aimed at conservation of resources and superimposed on an open market. Page denounced subsidies as an instrument that will destroy free enterprise and cited his experience in Jugoslavia as proof. He conceded that the Premium Price Plan accomplished its emergency purpose but believed that industry could have devised a better method if permitted by OPA. Williston severely criticized Government policies on quicksilver, saying that the State Department encourages the mercury cartel to destroy domestic competition, and cited the sale of a large

(*Continued on page* 123)

A Declaration of Policy by the Mining Congress

Asserting that certain conditions must be realized in the mining industry if it is to be put on a basis sufficient to supply the metals and minerals needed for peacetime industry as well as for national defense, and affirming that a national mineral policy must be established through cooperation of management, labor, and government agencies, the American Mining Congress at its Denver meeting (reported elsewhere on this page) formulated a declaration of policy to guide its actions. A liberal abstract of this declaration follows:

Labor Relations

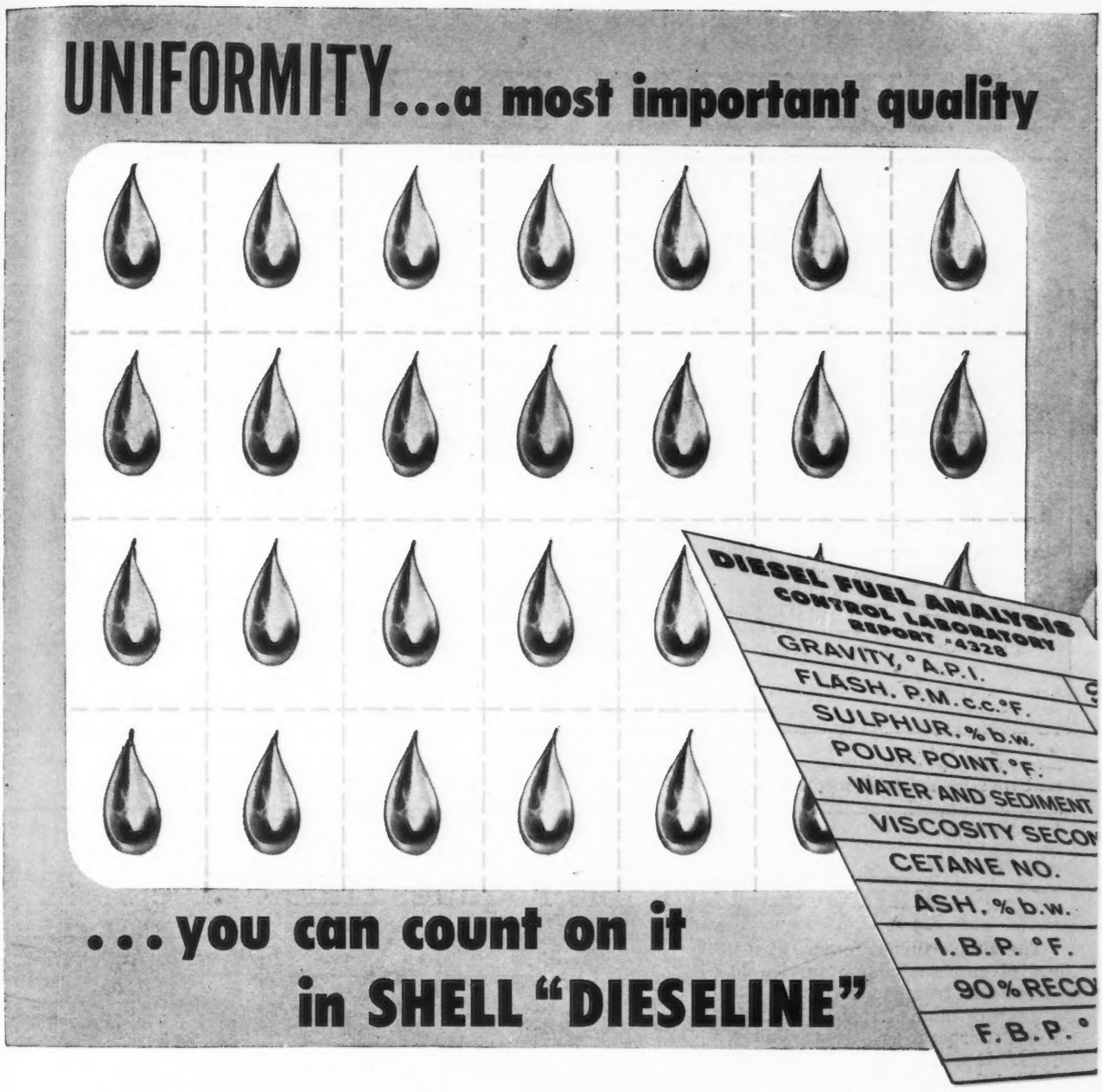
Charging that labor leaders had frequently bypassed collective bargaining in favor of strikes, even against the Government, in the past year, as a result of laws and policies that encourage such strikes, the Mining Congress called for prompt enactment of federal laws which will restore true collective bargaining and remove the causes which make the nation defenseless in the face of strikes. Strikes against the Government, against other employers than those involved in a given dispute, and strikes by a combination of unions to tie up an entire industry are economic weapons too dangerous to be in the hands of a few. The unions should be forced to decentralize and bargaining put on a plant or bargaining-unit basis, the industry-wide strike being prohibited and the unions, their officials and agents being made subject to the anti-trust laws. Unions should again be made responsible for the acts of their officers and agents and suable as legal entities in the courts.

Mass picketing, violence, and intimidation should be made unlawful and violators subject to court action. The National Labor Relations Act should be revised to prevent unfair labor practice by unions which cause strikes and lockouts. Employers should be as free as labor representatives to talk to their own employees about unionization, bargaining, or strikes.

The NLRB should be subject to the check-and-balance system and courts should have the right to determine whether the Board's findings of fact

(*Continued on page* 128)

UNIFORMITY...a most important quality



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YOU CAN ANALYZE shipments of Shell "DIESELINE" for uniformity—it's there! It is the month-after-month, year-after-year kind of uniformity that so many Diesel engine operators claim is the best single reason they know for specifying Shell "DIESELINE" for any medium- or high-speed engine.

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Why not try this modern quality fuel in your engines for a month or two? Keep records and compare with the results you've been getting. Very likely you will be surprised at the top-notch, *consistent* performance you get from Shell "DIESELINE."

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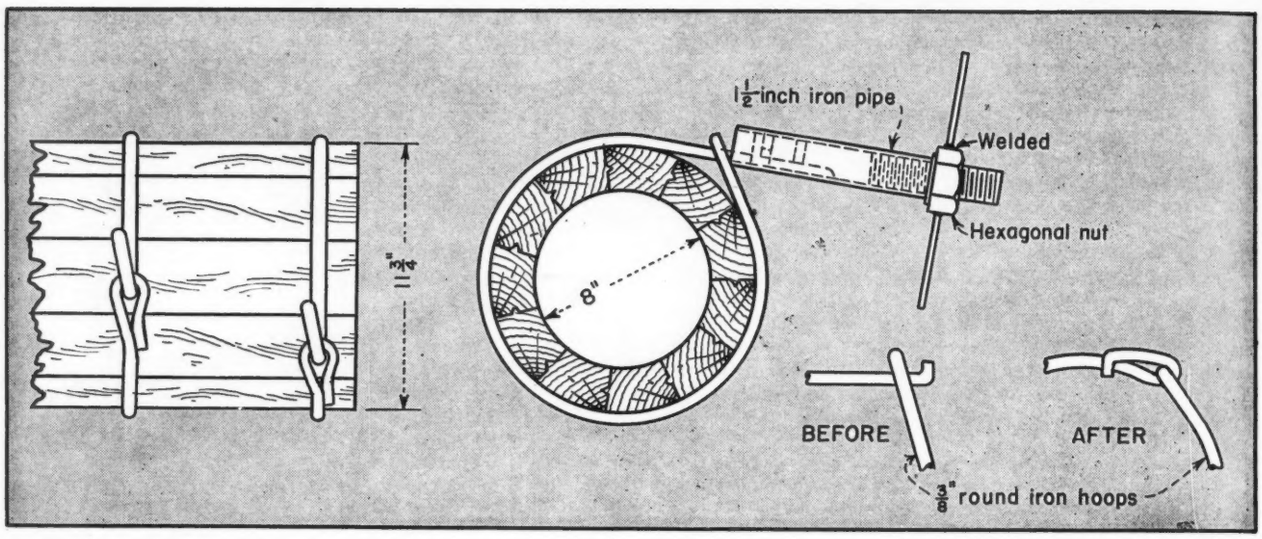
OPERATING IDEAS

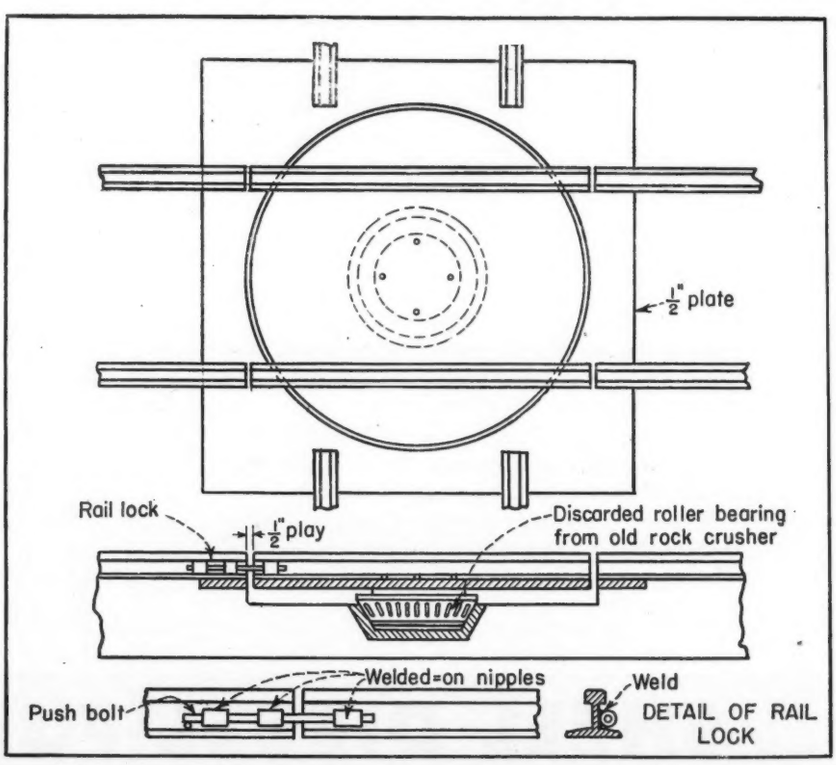
Assembly of Wood-Stave Pipes Is Simplified



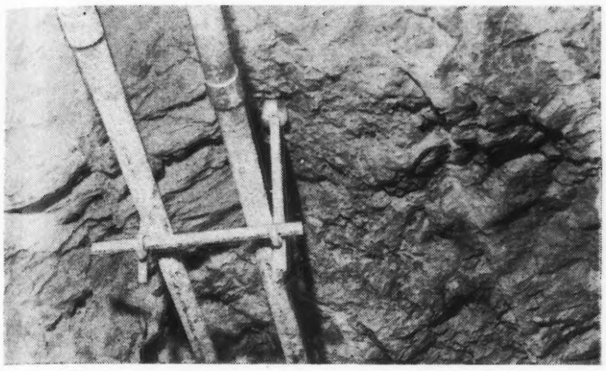
The assembly of wood-stave pipes with ⅜-in. round iron hoops has been much simplified with this device, which has been submitted by H. Grynberg, chief of mechanics department, Cia Minera Unificada Potosi operations in Potosi, Bolivia.

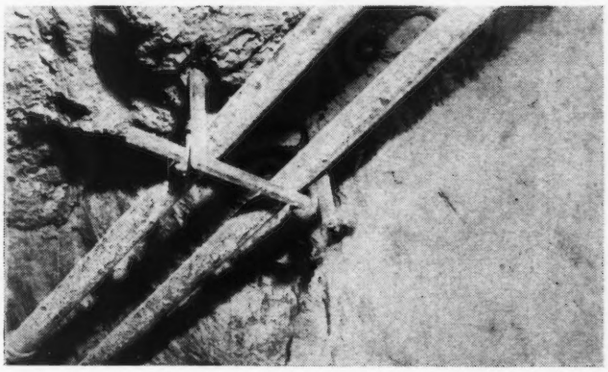
Improved Turntable Requires Little Upkeep

The simple turntable here shown has given satisfactory service at permanent transfer points at the Brunswick mine of Idaho Maryland Mines Corporation, Grass Valley, Calif. It was evolved by Joe Glennon, of the mechanical department. The turntable contains a large discarded roller bearing at the center of the circular table for the revolving mechanism instead of conventional rollers and slides installed along the periphery of the revolving table. The center roller bearing is greased by lifting out the revolving plates. There is practically no other upkeep. To insure smooth operation, a ½-in. play is maintained between the revolving table unit and the square base. When placed in the desired position, the track sections on the turntable and the track are held in perfect alinement by a push-bolt lock as shown.



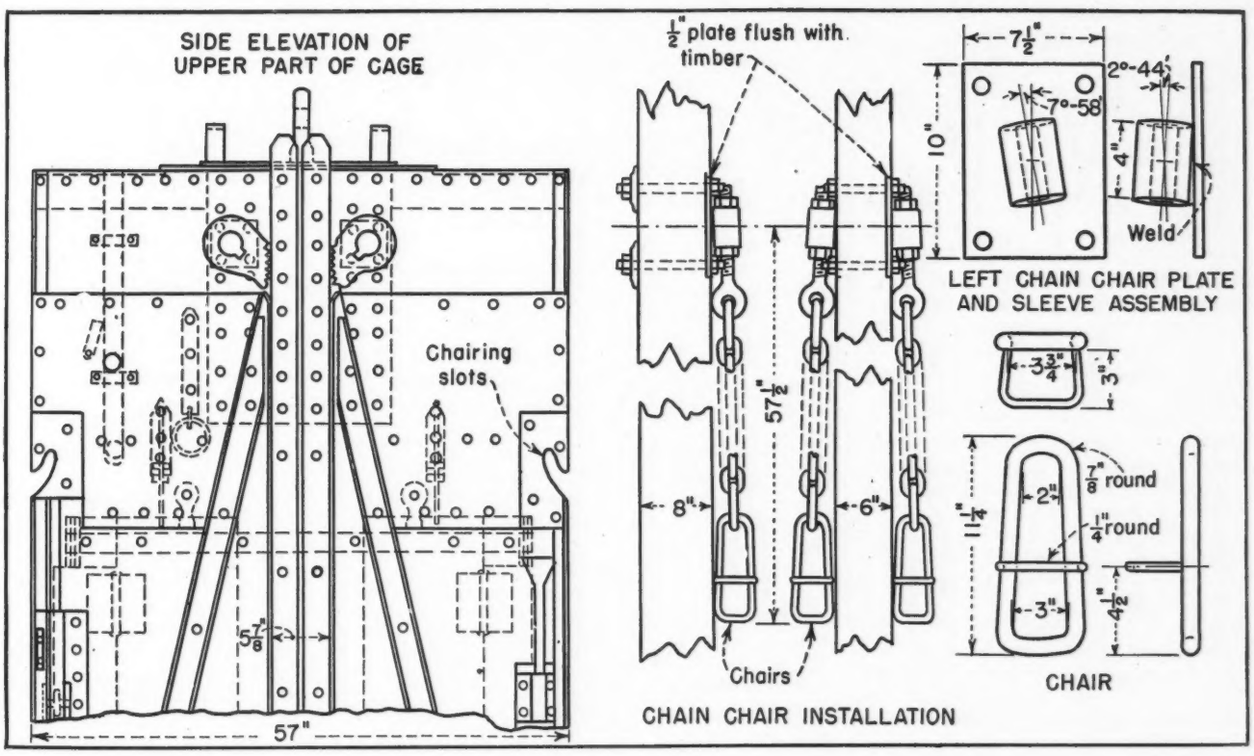
Pipe Hangers From Broken Drill Steels





Short lengths of worn-out or broken drill steel may be used to make pipe hangers as shown here. A short hook is welded to each of two drill steels, which are then inserted into holes in the back. A third steel resting in the hooks supports the pipe.

Chain Chair Is Easy to Operate



Although it has been standard practice in some mining districts to operate chain chairs to land cages because they are safer and easier to operate than certain retractible types, other districts are still unaware of these advantages.

The type shown in these illustrations, submitted by A. R. Farrell, master mechanic, Kirkland Lake Gold Mining Co., Ltd., Chaput-Hughes, Ontario, has performed satisfactorily for some time, and the cost of construction and installation is about one-fourth that for other types previously used. In the past, the company has received inquiries for design details from operators as far away as South Africa.

A notable feature is the convenience afforded the cager. In practice the cager grasps the chair by the handle and holds the lower widened link against the face of the cage corner posts as the cage slides by slowly to sill position. The lower link engages the chairing slots illustrated, thus holding the cage at the elevation desired for loading.

NEW BOOKS

MANAGEMENT CAN BE HUMAN. By Harvey Stowers, assistant to the president of Aircraft Industries Association of America, Inc. McGraw-Hill Book Co., 1946. 5¾x8¾ in. Pp. 131. Price, $1.50.

Mr. Stover's contribution to the McGraw-Hill Industrial Organization and Management series bases its claims to validity on the assumption that the social virtues are as indispensable in industrial and business life as in cultural and family association. His elaboration of this theme is valuable for the reason that only by processes of iteration may anything worth while be made assuredly assimilable and, above all, practicable. His offering is especially opportune in a time of crisis in relationships between management and labor, when the stresses and strains of frustration and readjustment impose a heavy burden on society in general and on industry, labor, and government in particular.

WOMEN IN INDUSTRY—THEIR HEALTH AND EFFICIENCY. By Anna M. Baetjer, assistant professor of Physiological Hygiene, Johns Hopkins University. Published by W. B. Saunders Co., Philadelphia and London. Pp. 344. Price $4.

This book has been prepared in the Army Industrial Hygiene Laboratory under the auspices of the National Research Council. Its chief claim for merit, according to the laboratory director, is that it presents information that would be valuable in placing women in industry properly when their service is required. No attempt is made to justify the employment of women in industry.

Among the seven sections of the book the first deals with the ability of women to work and the types and conditions of suitable work. Sections 2, 3, and 4 respectively deal with sick-absenteeism, accidental injuries, and occupational diseases. Secs. 5 and 6 have to do with gynecological and obstetrical problems. A summary is presented in Sec. 7.

METALLURGY OF QUALITY STEELS. By Charles M. Parker, Reinhold Publishing Corporation, 330 W. 42d St., New York. Pp. 248. Price $6.

In his foreword, the author, who is secretary of the General Technical Committee of the American Iron and Steel Institute, relates that the book is the outcome of several years of answering questions from "all sorts of persons" from executives to school boys. This explains why it is that the text, though far from being an elementary treatise, nevertheless contains the answer to many questions that frequently are asked by people who are not steel men but who have to do with steel and want to know more about it. For example, when is steel "carbon steel" and when is it "alloy steel," or what is the difference between "hardness" and "hardenability"? Of especial interest are the chapters dealing with steel quality as related to method of manufacture, ingot practice, chemical composition and control; inspection procedures and mechanical testing; annealing and normalizing; hardening; and the effects of alloying and incidental elements.

LINCOLN'S INCENTIVE SYSTEM. By James F. Lincoln. McGraw-Hill Industrial and Management Series. McGraw-Hill Book Co., New York. Pp. 192; 6x9 in. Price, $2.

Mr. Lincoln has produced an important and a provocative document. Every executive and all labor leaders might read it with profit. Coming from the pen of a notably successful business man, the text will evoke violent emotional reactions. The author has a vision, but he is not a visionary. He dares bluntly to indict and castigate those industrial practices on the part of management and labor that constitute a greater menace to the capitalistic, free-enterprise, and profit system than all the fulminations and conspiracies of economic crackpots and communistic theorists that strut the contemporary stage.

He holds that incentive management is like a religious conviction. He believes in it passionately. He is in favor of retirement annuities, full partnership of management with labor, and an absolutely square deal based on basic moral conceptions accepted as valid (if not practiced) by all men of good will in all recorded ages of mankind. He believes in production for use, primarily, and holds that cooperative bargaining should supplant collective bargaining, thus eliminating the bureaucratic meddling which has proved so ineffective and futile. He would return to piecework as a wage basis in industry. (How white collar workers and professional folks might fare under such a system, he does not prophesy. To pay a postman on the basis of letters delivered or miles walked; a policeman on the number of criminals apprehended, or a bassoon player on the number of toots contributed, would demand more than a court of nine Solomons.)

"Lincoln's Incentive System" emphasizes the need of education in morals—education in industrial and financial principles, in the ethics of business, in sound relationship between management and worker.

Many readers will regret that Mr. Lincoln, in the preparation of his copy, apparently dispensed with that professional editorial literary service which, fortunately, most authors consider indispensable.

All labor is essentially an assembly line. And both capital and labor may well ponder the significance of the following episode: At a moment when things had ceased to roll, a foreman, under justifiable stress, remarked to one of his subordinates: "Do you know, Jones, you're the slowest man on this crew." Which observation evoked the reply, "Well, Boss, in any gang some one has always got to be the slowest. Seein' that's so, I figure that in this bunch it might as well be me."

Without pride in accomplishment, all labor tends to become mere drudgery. W.N.P.R.

PUBLICATIONS RECEIVED

"Geological Aspects of Prospecting and Areas for Prospecting in the Zinc-Lead District of Northwestern Illinois." By H. B. Willman, R. R. Reynolds, and Paul Herbert, Jr. Report of Investigation No. 116, Illinois State Geological Survey, Urbana, Ill. Pp. 48 plus maps.

(A summary of this pamphlet states that zinc ore totaling 3 to 4 million tons, and averaging 4 to 5 percent zinc, is probably present in the Upper Mississippi Valley zinc-lead district, according to the available drill data. These deposits are commonly 100 to 200 ft. wide, 500 ft. to a mile long, and at depth usually of between 50 to 250 ft. thick. The major deposits have been largely in the vertical zone of about 100 ft. in the lower part of the Galena formation and the underlying Decorah and Platteville formations. The report discusses the significance of theories of origin as related problems in prospecting and the selection of areas. Possibilities of about 50 properties and mines are discussed.)

Geologic Map of Illinois, as of 1945. Illinois State Geological Survey, Urbana, Ill. Price 35c.

Nova Scotia. "Annual Report of Mines, 1945." Published by the Department of Mines, Halifax, N. S.

Transvaal Chamber of Mines. Proceedings of Annual Meeting, at Johannesburg, March 25, 1946.

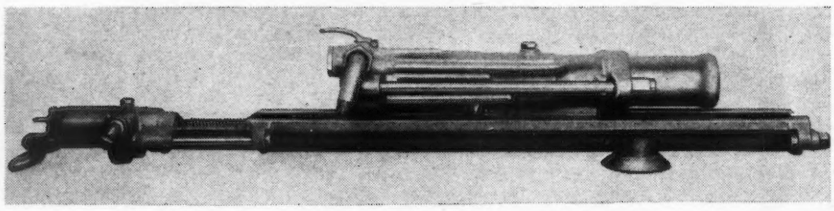
The truck body and lifting mechanism above is built of J&L Otiscoloy high tensile steel which is stronger than ordinary steel. The inherent strength of Otiscoloy is obtained without mechanical working or heat treating. This makes it particularly suitable for welding and fabricating operations. Its resistance to abrasion and atmospheric corrosion is also an advantage in trucks and many other applications. Write for Otiscoloy booklet.

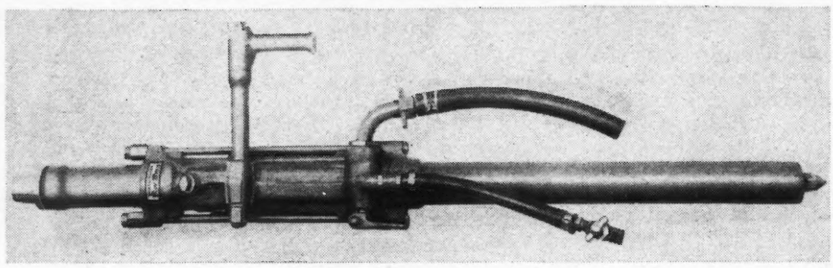
JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

EQUIPMENT NEWS

Worthington Announces New Rock Drills





A complete new line of Blue Brute drifters and a new self-rotating stoper have been announced by Worthington Pump & Machinery Corporation. Manufactured in three sizes, 3-in., 3½-in., and 4-in., each drifter is available as a hand-cranked model (WHC), or with an air motor drive mounted on the guide shell (WPMS), or with the air motor on the back head of the drifter (WPM). Model WPMS is pictured. The air motor is of the six-vane rotary type with simple spur gears.

The manufacturer states that the new drifters are of advanced design, light in weight, and well balanced. They are equipped with standard four-pawl rifle-bar rotation and the proved Worthington end-seating, positive-acting automatic valve. Valve and piston action is balanced for smoother action. For details, write for Bulletin H-1200-B33 to Worthington-Ransome Construction Equipment Division, Holyoke, Mass.

The new stoper, shown at the bottom in the photograph, incorporates a new and exclusive Worthington design in that the four-pawl rifle bar is used with air-thrown pawls set in a pawl housing in the cylinder, and the rifle bar has a ratchet at the lower end that engages the pawls on the back stroke of the piston. A shield type threaded chuck is furnished for all sizes and sections of shankless drill steel and a constant air blast keeps water and mud out of the front end of the drill. For other features, see Bulletin H-1200-B30.

High-Pressure Packing

Woven asbestos cloth, frictioned with heat-resistant compound and moulded into a V-shape, forms the basis for the new Raybestos-Manhattan (Manheim, Pa.) packing for steam or air rods, valve stems, boiler feed plungers, and hydraulic rams. The V shape, which is a feature of the design, insures automatic sealing, with a minimum of surface friction on the pressure stroke and no friction on the return stroke.

Small, Powerful Air Hoist

Weighing only 85 lb., yet capable of lifting 500 lb., the new air hoist recently announced by Sullivan Division of Joy Mfg. Co., Michigan City, Ind., is only 18 in. long, 9⅛ in. high, and 11 in. wide. Powered by a simple four-cylinder, reversible, piston-type air motor, and light enough to be moved by one man, the AW-80 Air-Winch can be mounted in any position on car, timber, column, or bar. Rope capacity is 150 ft. of ¼-in. rope; equipment which is regularly supplied with the hoist includes clamps for bar mounting, but other mountings are feasible. For details, ask for Bulletin 76-H.

High-Power Caps

An explosive that is 50 percent more powerful than TNT forms the basis for the new "Big Inch" blasting caps recently announced by Western Cartridge Co., East Alton, Ill. Known as cyclonite, or RDX, the new explosive was developed during the war, and was used in blockbuster bombs, bazooka charges, and shaped charges for demolition work. Because of its high power and fast detonation rate, RDX makes possible use of a cap only 1⅛ in. long and less than ¼ in. in diameter. The new cap is said to be safer in handling and storage than the conventional variety.

INDUSTRIAL NOTES

Clifford Hoag, until recently on the staff of Cotopaxi Exploration Company, Lalacunga, operating in Ecuador, has returned to the United States. His address is Route 6, St. Johns, Mich.

Leslie C. Hughes, consulting chemical engineer, has been appointed consulting engineer to **H. K. Ferguson Co.,** Cleveland, Ohio.

Nordberg Mfg. Co., Milwaukee, Wis., announces consolidation of its Los Angeles and San Francisco offices in a new building at 674 Harrison St., San Francisco, Calif.

Warren J. Holmes has been named export representative in the Philippine Islands for Allis-Chalmers Mfg. Co., Milwaukee, Wis.

BULLETINS

Diamond Core Drilling. Catalog No. 9, Section 1, E. J. Longyear Co., Minneapolis, Minn. This section is devoted to diamond core drilling, sampling methods, surveying of drill holes, controlling hole direction, and suggestions for selecting a drilling outfit. Pp. 32.

Diamond Drill. Bulletin No. 64, E. J. Longyear Co., Minneapolis, Minn., describes Longyear's new air-driven Gopher drill for coring and blast-hole work. Two capacities—Model 30 will drill 250 ft. at 3,000 r.p.m. and Model 15 500 ft. at 1,500 r.p.m.

Buyers' Guide. A new bulletin with the title, "Buying Guide of Allis-Chalmers Equipment for the Process Industries," has been issued by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Diamond Core Drills. E. J. Longyear Co., Minneapolis, Minn., has issued the following: Bulletin 57, on the UG Straitline drill for taking core down to 1,750 ft. depth. Bulletin 58, on the Master Straitline drill for deep core drilling, with which an AX hole can be drilled to 4,250 ft. deep, and NX hole to 3,250 ft. Bulletin 61 on the Junior Straitline for use on surface or underground. This machine will take ⅞-in. core to 900 ft. or 1⅛-in. core to 750 ft. Bulletin 69 on the Pioneer Straitline, which will take ⅞-in. core to 600 ft. Bulletin 70 on the rugged, light Porta drill for prospecting to shallow depths (¾-in. core to 150 ft.).

Hose Connections. A catalog section on its rubber-to-rubber hose connections (Flexseal joint) is available from B. F. Goodrich Co., Akron, Ohio.

Employee Information. Information manuals for employees are discussed in a new report prepared by the Policyholders Service Bureau, Metropolitan Life Insurance Co., 1 Madison Ave., New York 10, N. Y. The study is based on an analysis of 132 such manuals used by 119 companies in the U. S. and Canada, and it is available to executives.

DOWN GO COSTS WHEN THEY'RE

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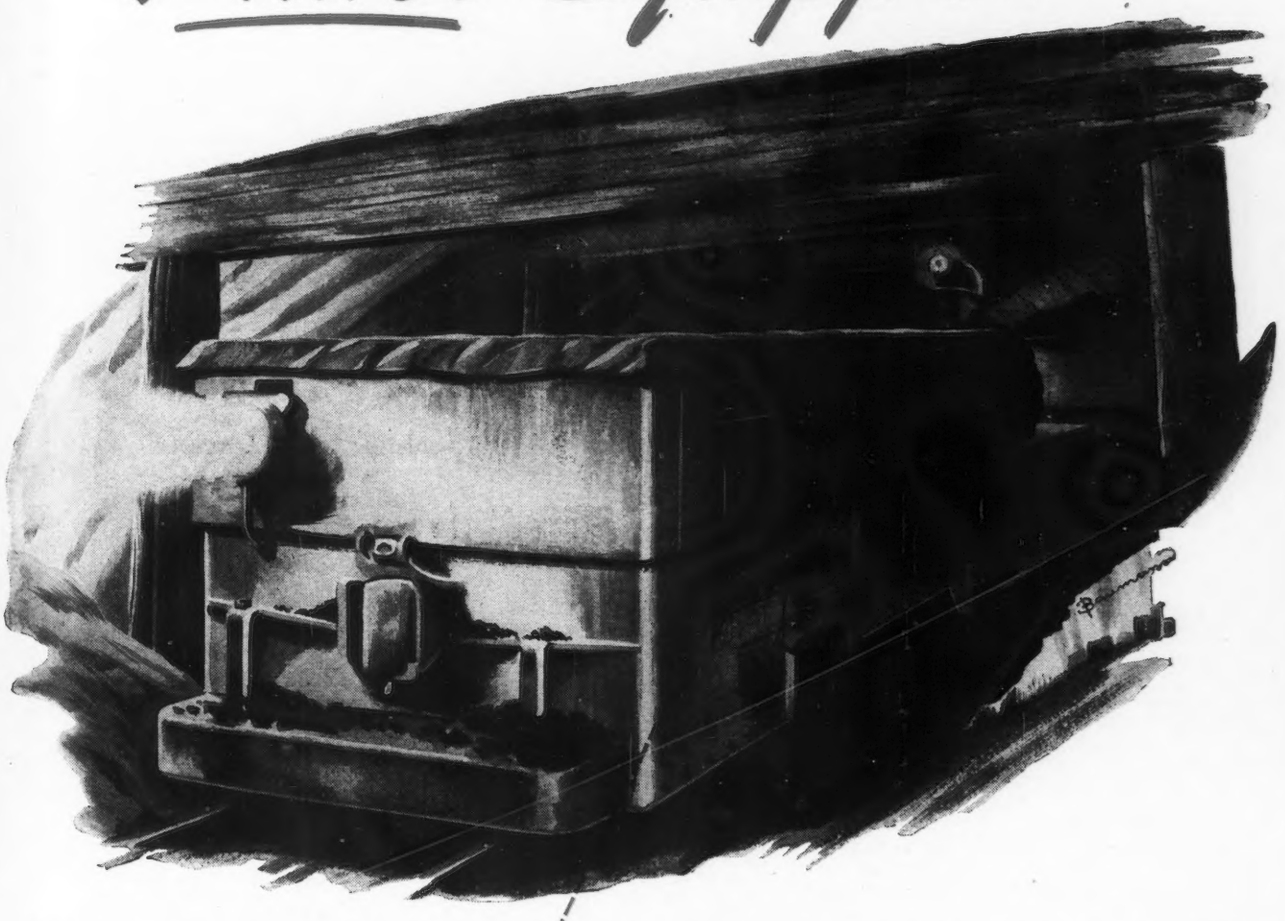
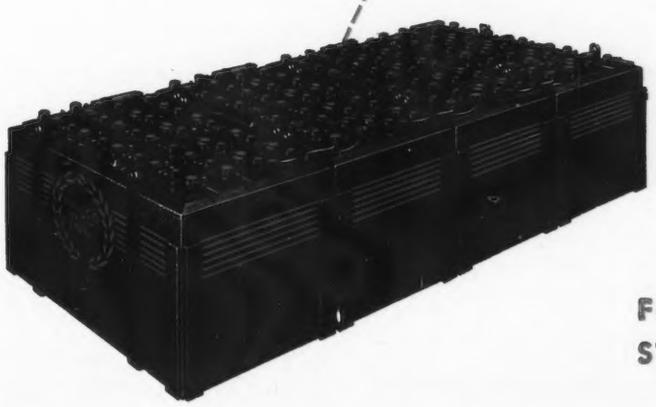


Many operators are getting more work at low cost from locomotives and other mine haulage equipment by changing to modern extra capacity* Philco Storage Batteries. This swing to Philco has gained by leaps and bounds since the introduction of the sensational new Philco "Thirty" Mine Batteries, with 30% longer life. Of course Philco "Thirty" has the modern construction that gives 10% extra capacity* with no increase in overall size. Write for a catalog of specification data today. **PHILCO CORPORATION,** Storage Battery Division, Trenton 7, New Jersey.



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PERSONAL NEWS

A. F. Horle, general superintendent for Cia. Minera Asarco at Parral, Chihuahua, was in New York recently, having come to this country for a vacation.

Alfred W. Dodd, vice president of American Zinc, Lead & Smelting Co. at St. Louis, Mo., resigned as of Oct. 1. He had been associated with the company for 30 years. Before joining American Zinc, Lead & Smelting he had been connected with New Jersey Zinc and with Granby Mining & Smelting Co.

W. H. Hannay, senior research engineer of Consolidated Mining & Smelting Company of Canada, Ltd., has announced his retirement after 43 years in the service of the Consolidated company. He played an important part in the development of selective flotation.

R. J. A. Manning, formerly of the staff of the British Columbia Industrial and Scientific Research Council, has been appointed assayer for Kenville Gold Mines, Ltd., Quebec Gold Mining Corporation subsidiary.

E. G. Langille, formerly on the staff of Silbak Premier Mines, Ltd., has been appointed mine manager for Big Four Silver Mines, Ltd., at the company's property in the Portland Canal district of British Columbia.

Dr. Arthur Roy Clark, a former member of the staff of Noranda Mines, Ltd., has been appointed to the physics department of the University of British Columbia. Dr. Clark will lecture on geophysical prospecting, which subject will be optional in the new engineering and physics courses starting this fall.

Henry M. Howard has been appointed professor of mineral dressing at the University of British Columbia; and **W. M. Armstrong** has been made professor of physical metallurgy.

Arthur C. Rader, mining engineer, has opened an engineering office in the Pittsburgh Block, Helena, Mont.

Dr. A. M. Gaudin, Richards professor of mineral dressing at M.I.T., visited Butte with Mrs. Gaudin in the early part of August. Dr. Gaudin was research professor of mineral dressing at the Montana School of Mines from 1929 to 1936.

Alan A. Sharp, of Pittsburgh, has replaced **H. C. Loesche** at the Phoenix Safety Station of the United States Bureau of Mines. Loesche has been transferred to the Berkeley, Calif., office.

Herbert H. Mellus, recently discharged from service with the United States Army, has accepted a position on the engineering staff of the Inspiration Consolidated Copper Co.

Arthur B. Cleaves, Ph. D., has been appointed associate supervisor of geology and geological engineering at Washington University at St. Louis, Mo.

R. Z. Williams has been appointed assistant dean at the Missouri School of Mines, at Rolla, Mo. He is a graduate of the School—B.S. in metal-

R. Z. WILLIAMS

lurgy, 1931, with highest honors—and was in 1934 associated with interests responsible for the development of the deposits of iron ore in the Missouri Ozarks. He assumed his new duties on Sept. 1.

Hugh R. Brankstone, geologist, has been elected president of the Pittsburgh Geological Society for 1946-47. Other officers include **Dr. Shailer S. Philbrick,** vice president; **W. B. Robinson,** secretary; and **C. H. Feldmiller,** treasurer.

A. A. Friedman, general superintendent of New Saza Mines, Ltd., Chunya, Tanganyika, British East Africa, returned to this country on a visit to Berkeley, Calif., in August.

Walter W. Bradley has announced his retirement as State Mineralogist of California on Aug. 1. Mr. Bradley had been associated with the State Mining Bureau and its successor, the present Division of Mines, for 35 years. His address is 1671 Arch St., Berkeley 4, Calif.

Walter T. Leonard retired on Sept. 1 from his post of superintendent of timber lands for Oliver Iron Mining Co., Duluth, Minn., after 40 continuous years of service. He is succeeded by **John Steinke,** who had been assistant superintendent.

J. Fred Wolff has been made assistant general mining engineer of the Oliver Iron Mining Co., Duluth, Minn. He has been with the company since 1908 and is an authority on the geology of the Lake Superior district and particularly on that of the Mesabi Range.

W. A. Knoll, general superintendent for Pickands, Mather & Co. on the Gogebic and Marquette ranges, was chosen chairman of the Upper Peninsular section of the A.I.M.E. at a meeting in Iron River on Sept. 7. **Dr. Roy W. Drier** was elected secretary-treasurer.

D. M. Kelly, vice president in charge of Western operations for the Anaconda Copper Mining Co., has resigned active duties but will continue in an administrative consulting capacity. He is succeeded by Edward S. McGlone, general manager of Western mining and metallurgical operations for the company.

Leon DuPuy is acting chief of the mining branch of the U. S. Bureau of Mines at Rolla, Mo., in the absence of **C. H. Johnson,** who has been called to Washington, D. C., on special work.

Noel Kirby has been appointed assistant general superintendent of the Risdon works of Electrolytic Zinc Company of Australasia, Ltd., Tasmania.

Nathan H. Mannakee, Jr., employed with the Premium Price Plan for copper, lead, and zinc until October, is now practicing as a consulting mining engineer and may be reached at Cascade, Mont.

Manuel M. Aycardo, Jr., mining engineer, is with International Engineering Corporation of Manila, at the property of North Camarines Gold Mining Co., Paracale, Camarines Norte, P. I.

L. W. Reed has resigned his post as mine manager for Rebair Gold Mines, near Atikokan, Ontario.

A. G. Vance, mining engineer, has been made manager of Russett Red Lake Gold Mines, Ontario.

Edward C. Logelin, Jr., has been appointed director of public relations for the United States Steel Corporation subsidiaries in the Chicago district. He succeeds **Arthur C. Wilby,** who was elected vice president, of U. S. Steel Corporation of Delaware on Aug. 14.

Royal C. Huber has been appointed personnel supervisor of the Hibbing-Chisholm district of the Oliver Iron Mining Co.

H. S. H. Donald, who retired recently from the position of Government Mining Engineer of South Africa, has joined the Anglo American Corporation of South Africa as manager of the Corporation.

G. H. Beatty has retired from the position of joint general manager of

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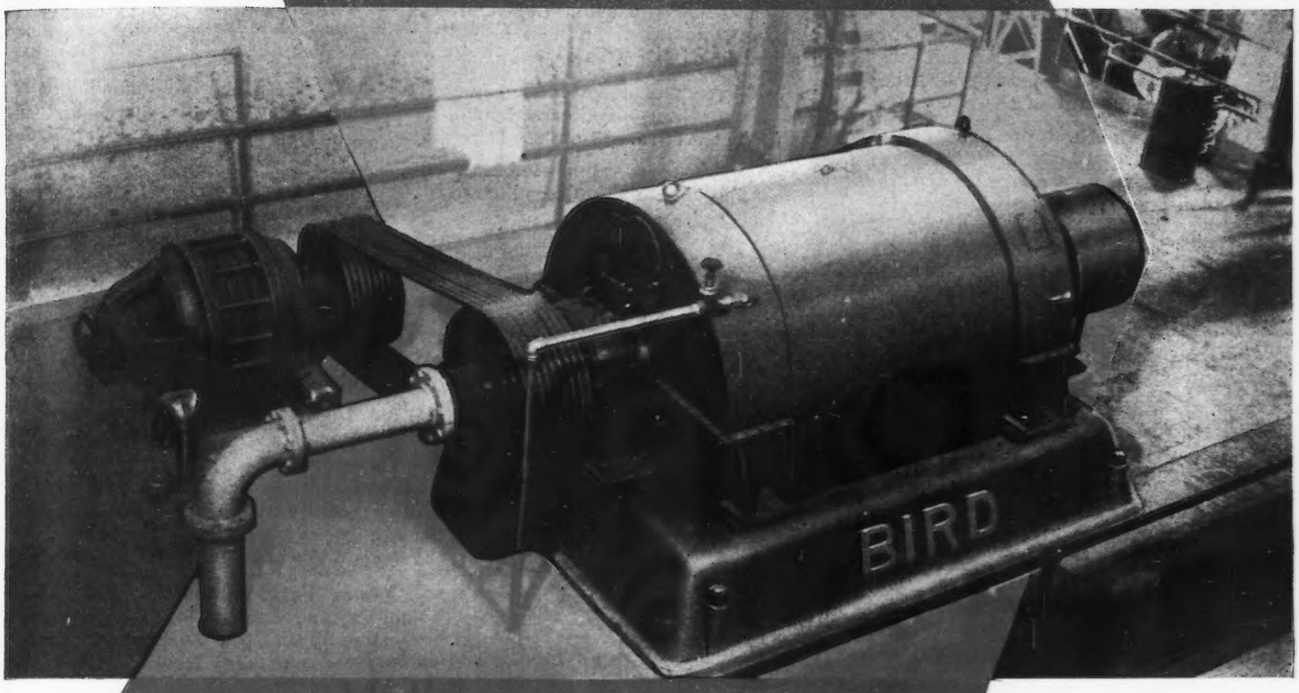

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the Johannesburg Consolidated Investment Co. **K. Richardson**, who has been joint general manager and consulting engineer of the company since early this year, has been appointed general manager, and **D. A. B. Watson** succeeds him as consulting engineer in South Africa.

George E. Woodward, chief, Mineral Economics Division, U. S. Bureau of Mines, has been assigned to compile a report on mineral resources and mineral economics of Japan.

Thomas E. Brown, dynamite supervisor at the Hercules, Calif., plant of Hercules Powder Co., has been appointed assistant superintendent of the Bacchus, Utah, plant of the company.

Lionel E. Booth, Salt Lake City, Utah, metallurgist, and **M. C. Irani**, of Bombay, India, have formed the firm of Booth-Irani, Inc., with offices in the two cities. The India office will conduct a metallurgical service.

Sherred A. Williams has been elected president of the Mining Society of Nova Scotia.

C. Ted Phillips has been retained as manager of the Quartzite Gold Mining and Milling Co. at Quartzite, Ariz. He formerly operated the Julius claim now included in the Quartzite company's holdings.

Wayne B. Spear, formerly employed by the Miami Copper Co. in Arizona, is now serving as mining engineer with the New York & Honduras Rosario Mining Co. at San Jacinto, Honduras, Central America.

Bahngrell W. Brown, formerly field engineer with the Arizona Department of Mineral Resources, is at present stationed in Kyoto, Japan with the 10th Chemical Service Company.

C. J. Irvine, manager of Geldenhuis Deep, has been elected president of the Chemical, Metallurgical, and Mining Society of South Africa.

F. B. McMagh has been appointed full-time Mining Commissioner for the Orange Free State.

A. G. Glenister has been re-elected chairman of the Malayan Chamber of Mines.

Herbert S. Woodward, metallurgist formerly with Basic Magnesium, Inc., at its Gabbs concentrator, has established a metallurgical laboratory at Goodsprings, formerly productive district in Clark County, Nev.

Dr. Harry J. Klepser, of the U. S. Geological Survey, and **Chia Hsiang Chao**, Chinese geologist, have been making geological examinations in the Kentucky-Illinois fluorspar district in recent weeks.

Sir Herbert Gepp, who was largely responsible for the establishment and initial development of Electrolytic Zinc Co. of Australasia, Ltd., has been absent in Japan on a technical and scientific mission.

F. R. H. Green has been made Chief Inspector of Mines of Sierra Leone, British West Africa.

S. Haymes has been appointed manager of British Guiana Consolidated Goldfields, Ltd.

G. B. MacKenzie is now general manager of Marampa Mines of Sierra Leone Development Co., Ltd.

George A. Lamb, Assistant Director in charge of economics, statistics, and administration of the U. S. Bureau of Mines since 1944, is leaving Government service on or about Oct. 15 to take a position in private industry. He will join the Pittsburgh Coal Co. as business analyst. Mr. Lamb has been in Government service in Washington since 1930, when he started as a transportation economist with the Department of Agriculture.

Frank A. Ayer, whose election as vice president of Copper Range Co. was announced on page 116 of the August issue of *E.&M.J.*, may be addressed at 40 West 40th St., New York City. The address 40 West 42d St., given in the notice mentioned, was an error in transcription.

Correction

In Mr. Vedensky's article on the Three Kids manganese plant in the July, 1946, *E.&M.J.*, it was incorrectly stated in the third column on p. 64 that high-grade manganese nodules could be produced by the SO_2 method "at a processing cost of $0.50 to $0.60 per ton." The sentence should have read, "at a processing cost of $0.50 to $0.60 per unit of manganese contained in the final product, exclusive of cost of ore."

OBITUARIES

Cornelius Joseph O'Neill, 66, superintendent of Silver King Coalition Mines Co., Park City, Utah, until his retirement in 1945, died on Aug. 18 near Park City.

Frank Ogden Chase, 52, mining engineer who developed and brought into production mining properties in Utah, Nevada, and California, including the Rio Tinto mine, at Mountain City, Nev., sold to International Smelting & Refining Co. in 1933, died Aug. 12 in Tucson, Ariz.

Frank Bodfish, engineer and mining operator who had played a prominent part in development of the Cripple Creek (Colo.) district, died Sept. 3 at Ironside, Ore.

A. S. Knight, a former mine manager, died recently in South Africa. Mr. Knight was general manager of East Geduld Mines, Ltd., from which position he retired about nine months ago.

John W. Henderson, pioneer Western miner, died at Arcadia, Calif., on July 7 of this year.

Gilbert E. Seil, metallurgist and technical consultant to important business and government interests, died on Sept. 11 at Philadelphia at the age of 57.

Russell P. Reymonds, 66, metallurgist and manager of American Smelting & Refining Co. at Denver, Colo., until his retirement a year ago, died on Aug. 30.

Robert H. "Bob" McConnell, long associated with the mining industry in the Patricia district of Ontario, died recently at Sioux Lookout at the age of 55.

J. V. Claypool, industrial relations manager of the Oliver Iron Mining Co. in Duluth, died on Sept. 14.

Chalapha George Goss, 88, veteran mining man and merchant, died July 26 in Salt Lake City.

Archie E. Wilson, 74, prominent mining man of Stevens County, Wash., died recently.

Casey Stites, 64, treasurer of the Cananea Consolidated Copper Co., died recently at his home in Cananea, Son., Mexico where he had been a resident since 1900.

James Park, mining engineer, geologist, and author, long active professionally in New Zealand, died recently at Dunedin, New Zealand, at the age of 89.

A LETTER

A Comment on Antimony Smelting in Wartime Germany

(As recorded by A. J. Phillips in Eng. & Min. Jl., p. 93, June, 1946)

The Editor:

The unique method of smelting antimony concentrate, as adopted at the Herzog Julius Hütte during the War, is admittedly based upon the following reaction:

$$Sb_2S_3 + 3\ Na_2CO_3 + 6C = 2Sb + 3Na_2S + 9CO$$

But up to a certain point the resulting Na_2S will react back on the original Sb_2S_3, with the formation of sodium thioantimonite, $NaSbS_2$ or Na_3SbS_3 or both, or some other complex thioantimonites.

Experimentally it can be shown that using a crucible with an excess of say 10 percent sodium carbonate, together with an excess of say 20 percent carbon in the charge, the re-

(*Continued on page* 101)

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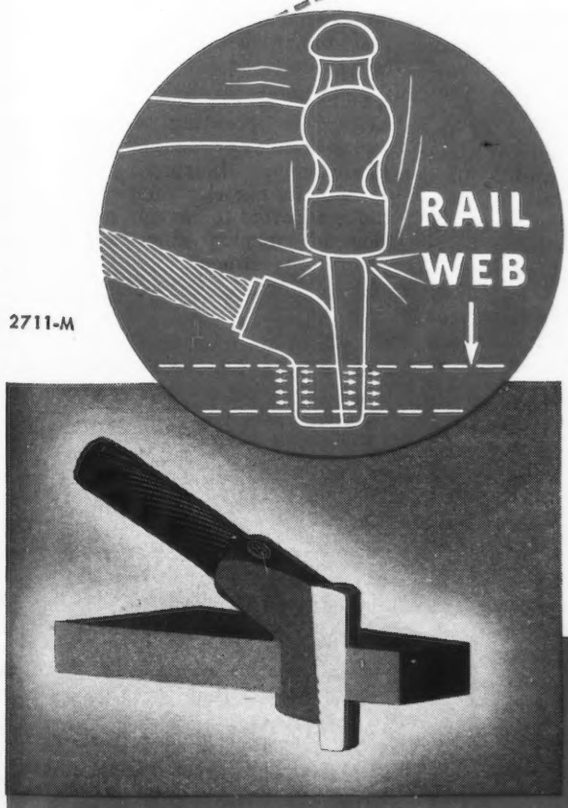
20,000 lbs. of expansion pressure "Cold-Welds" O-B WEDGE-BOND TERMINALS to rail



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Wedge Action — a few hammer blows are transformed into 20,000 lbs. of expansion pressure.

Because it utilizes the Wedge, one of man's most powerful "machines", you can do a better bonding job with an O-B Wedge Bond. A few hearty hammer blows on the wedge are transformed into 20,000 lbs. of expansion pressure. The terminal is thus "cold-welded" to the rail in a positive, permanently-tight mechanical and electrical joint. No special tools or talents are required for its installation. Wedge Action distributes the pressure evenly throughout the hole in the rail web, insuring a uniform, corrosion-proof bond. Why not put the power of Wedge Action to work for you? Specify O-B Wedge Bonds.

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Canadian Ohio Brass Co., Ltd., Niagara Falls, Ontario

REGIONAL NEWS

MONTANA

Castle Mining Co. to broaden operations — Ruby Gulch mill reaches 300-ton rate

★Castle Mining Co., headed by B. H. Castle, of Helena and Spokane, expects to enlarge its operations soon. It has purchased the Montana properties formerly held by Silver Crescent Mining & Milling Co., of Spokane, consisting of the Cruse Bald Mountain mine, at Marysville, Lewis and Clark County; the Franklin mine, in the Scratch Gravel district, near Helena; and the Vosburgh mine, in the Winston district, Broadwater County. These properties are said to be fully equipped.

★Ruby Gulch Mining Co., at Zortman, Phillips County, is operating at full capacity, mining and milling 300 tons per day, which is crushed to about § in., and cyanided. The company is treating a low grade of oxidized gold ore. Carl J. Trauerman, of Butte, is president; Mrs. Katie B. Whitcomb, of Malta, vice president; and Mrs. Al Engle, Zortman, secretary-treasurer. Edgar A. Scholz is general manager.

★Saranac Mining Co is putting its equipment in condition to start shipping ore from its silver-lead properties, 15 miles northeast of Philipsburg, Granite County. The company was organized by R. K. Neill, Conrad Wolfle, and W. E. Cullen, all of Spokane, and Seattle associates.

★Garrison Mining Co., of Seattle, Wash., has qualified to operate near Virginia City, Madison County. Ruppert Garrison, formerly an operator in the Virginia City district, heads this company.

★Mrs. Camilla Gage, of Twin Bridges, Madison County, one of the few women mining operators in Montana, has given a bond and lease on the Emma mine to the Silver Shield Mining & Milling Co., 501 Felt Building, Salt Lake City. The property is in the old camp of Rochester, west of Twin Bridges, and is equipped with a small mill, from which it has been producing lead and zinc concentrates containing gold and silver. Silver Shield is headed by Louis Stein and M. W. Woolley. Joe Buhler, of Salt Lake City, will be in charge.

★An interesting land title ruling has been made by R. V. Bottomly, State Attorney General, for J. M. Watts, attorney, of Musselshell County. The county had taken title to a tax-delinquent mining claim, including surface and underground mineral rights, and sold the surface rights only to a purchaser. The latter claimed that the mineral rights went with his purchase and that the county had no right to divide the property. The Attorney General ruled that the county had the right to divide such land as it chose after the advertised sale date. Under State statutes, Bottomly explained, one party—a rancher for instance—could buy surface rights to that type of land, and another could purchase the mineral rights, with the latter having a lawful right to mine or drill under the surface owned by the rancher.

★ The Reconstruction Finance Corporation announced on Aug. 31 that the Domestic Manganese & Development Co. has been named to operate the flotation plant at Butte as a custom mill to treat lead-bearing ores. This action was taken at the direction of the Civilian Production Administration.

IDAHO

Clayton Silver Mines opens new orebody — Polaris sets shaft-sinking record

★Production of lead and zinc from old river tailings in the bed of the South Fork of the Coeur d'Alene River, between Wallace and Mullan, is showing signs of exhaustion. Zanetti Brothers are now cleaning up the last of the deposit accumulated above the old Standard dam and have leased a small deposit near the Moe Mining Co. property. Several thousand tons have been treated from the Standard dam deposit during the past two years.

★Hecla Mining Co. has declared its third quarterly dividend of 25c. a share for 1946, totaling $250,000 and payable Sept. 13 to stock of record Aug. 13. The company's dividends this year have amounted to $750,000, and the grand total to date is $29,655,000. Hecla is approaching the end of its big tailings sink-and-float operation at Osburn, which was originally estimated at 2,000,000 tons and was later increased to 3,000,000 tons.

Hecla's operating statement for the second quarter of 1946 shows a net profit of $640,961.81 before taxes, depreciation, and depletion. Ore shipments netted the company $216,728.91 after deducting operating expenses. Other sources of income included $126,450 dividend from Polaris Mining Co., $250,000 from the Sullivan Mining Co., and $47,782.90 from miscellaneous sources.

★The Nevada-Stewart Mining Co., in the Pine Creek area, has started work on a 2½-compartment raise on the orebody recently located in the lower tunnel. The ore removed in the raise operation is being milled at the Highland-Surprise mill.

★A deep tunnel has been started on Elk Creek, east of Kellogg, by the New Hilarity Mining Co. to develop the Wolverine and Paramount groups. The company has awarded a contract for the first 500 ft. of tunnel work.

★Polaris Mining Co. has declared a dividend of 10c. per share, totaling $200,000, payable Aug. 30 to stock of record Aug. 12. This brings 1946 dividend payments to $400,000 and the grand total to $1,940,000.

★Dayrock Mining Co. has started crosscutting on the 800-ft. shaft level to open a rich body of lead-silver ore opened on the 650-ft. level, where the oreshoot was exposed for 200 ft. in length with maximum widths up to 17 ft. On this level the clean ore assayed 76 percent lead and 48 oz. in silver per ton. The level is being prepared for stoping while the 800 level is being developed.

★Sullivan Mining Co.'s zinc plant at Kellogg is operating at reduced capacity because of manpower shortage. The company is running only two units of its big electrolytic zinc plant and is reported to have on hand 60,000 tons of surplus zinc concentrates awaiting treatment.

★Clayton Silver Mines, Clayton, reports discovery of a new body of silver-lead ore southwest of the shaft. The orebody has been explored for 150 ft., showing a face of milling ore the full width of the drift. Concentrates from this ore, produced in a six-day mill test, netted the company smelter returns of $21,791, averaging $152.39 per ton. Lead values were $90.44 and those of silver $61.95 per ton, an increase of $30 per ton over shipments from other parts of the mine. The new discovery is in line with the Silver Rule group of claims belonging to the Red Bird property, owned by Ford Motor Co. Norman Smith, one of the Sunshine Mining Co. geologists, is in charge of the Clayton development.

★Vindicator Mining Co., at Mullan, east of the Lucky Friday, has opened a mineral vein in its north crosscut at a considerable distance south of

FORGET CORROSION AS A SCREENING PROBLEM with ROEBLING *Stainless Steel Wire Cloth*

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For top corrosion resistance, you can't beat stainless steel. Roebling Wire Cloth made of this metal keeps its initial accuracy of weave throughout a long productive life. Its smooth surface minimizes clogging caused by certain materials on damp days. That means fewer shutdowns for maintenance or replacement . . . faster and more profitable production.

If corrosion is a problem in your cleaning, sizing or grading, call in a Roebling Field Engineer. His job is to help you select a stainless steel wire cloth in the wire diameter, mesh size and open area that will give you most production at least over-all cost and trouble.

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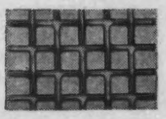
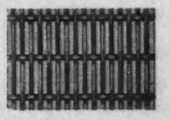


Galvanized Wire Cloth



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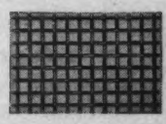

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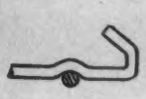
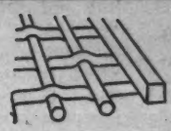


Turned Edge

Metal Reinforced Edge

Metal Reinforced Edge (with Insert)



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Idaho (*continued*)

the point where the crosscut is expected to encounter the Vindicator vein. Assays from the new find show 11.5 oz. silver, and 1.5 percent lead per ton.

★American Smelting & Refining Co. has resumed development work on the Highland-Aurora property in the Beaver district, north of Wallace, after a suspension of several months on account of manpower shortage. Federal Mining & Smelting Co. has charge of the development, which consists of sinking a shaft a depth of 1,000 ft., to be followed by development and prospecting of the vein system.

★Monitor Mining Co. has completed driving 800 ft. in the Carlisle tunnel, in the Beaver district, to effect a connection with the workings of the old Interstate-Callahan mine, north of Wallace. The new drive makes the Carlisle tunnel 7,200 ft. long and taps the Interstate shaft at a depth of 1,500 ft. The Interstate No. 4 tunnel to the shaft is 5,100 ft. long, which makes a haulageway through the mountains 13,800 ft. in length, or approximately 2½ miles. The connection was made to provide the company haulage facilities free from snow conditions from its Beaver Creek mines to the mill in Wallace.

★Polaris Mining Co. sank its three-compartment Silver Summit shaft 184 ft. during July, a record for the district. The only other comparable record was at the Sunshine mine, where, in December 1939, the Jewell shaft was lowered 175 ft. in 19 days, and again in November 1936 the shaft was advanced 180.7 ft. in 30 days.

★The Michaels & Fahle group, south of the Coeur d'Alene Mines group, at Osburn, has been sold to Spokane investors. These claims are to be included with the American Silver, Freeman & Sites, Silver Standard, and other groups entering into a 50-50 profit-sharing development program with Coeur d'Alene Mines, whereby the last-named company will drive a long cross-cut tunnel through the several groups from the 2,800-ft. level

WASHINGTON

Bids opened for aluminum plant at Tacoma—American Zinc miners return to work

★American Zinc, Lead & Smelting Co.'s miners went back to work at the Grandview mine and mill, and at the Metaline Mining & Leasing property, near Metaline Falls, on Aug. 26, after a two months' strike. The men were granted an hourly pay increase of 18½c., and back pay of 12½c. retroactive to May 1, and a six-day work week. The closed shop was refused. John R. Gallagher, international representative of the CIO said, "The union bypassed its demands for a union shop agreement this year. We still have the maintenance of membership clause in the contract." Nearly 200 men were employed when the strike began, some of whom are said to have taken other work in the area.

★Bids for the $6,500,000 war-built Olin aluminum plant at Tacoma have been opened at Portland, Ore., by the WAA. The three bids, received respectively from Reynolds Aluminum Co., of Richmond, Va.; Permanente Metals Corporation, of Oakland, Calif., and Eastern Metals Products Co., of Mount Vernon, N. Y., are to be considered and recommendations will be sent to Washington, D. C. The award will be made some time after Oct. 15. Reynolds' bid is for a five year lease, at $200,000 the first year, to be increased $50,000 each succeeding year. Permanente bid is for a five-year lease, with 2 percent of gross sales the first year and an increase of half of 1 percent each year thereafter. Eastern Metal's bid is also a five-year lease, with $60,000 minimum guaranteed the first year, with an increase of $15,000 each succeeding year, plus 10 percent of the gross earnings before taxes.

★Five men employed at Big Lake mining property, near Kettle Falls, have extended the tunnel 900 ft., according to Will Everett, president. A survey indicated the hanging wall to be about 50 ft. farther. Aerial photographs were to be taken in August.

CALIFORNIA

Gold-dredging operations are expanding — Siskiyou County gold properties reopen

★ Standby Mining Co., controlled by Los Angeles interests, is reopening the old St. Paul mine, near Railroad Flat, Calaveras County, and rehabilitating the surface buildings. Development planned includes deepening the old shaft an additional 100 ft. and lateral work at the present bottom of the shaft. W. H. Gardner is manager. Seven men are employed.

★ Gold dredging continues to expand, and it is estimated that about 65 percent of the State's output of gold is thus obtained. Natomas is working seven large dredges, and Yuba Consolidated Gold Fields has 13 units in operation or ready at the different placer holdings in the State. The already large number of dragline dredges at work in placer areas is increasing steadily, and many "snipers" are active along the tributaries of the American, Feather, Klamath, Sacramento, Yuba, and other streams for the first time since 1942.

★ American Metal Co., of Colorado, is reported to have started exploration and development at the old Mammoth gold mine, near Lake Mary, Inyo County, with 16 men under E. J. Roberts, resident manager.

★ Mining and milling have been resumed at the King Solomon mine, near Johannesburg, Kern County, by Max Hess and James Christensen, who lease the property, owned by Shipsey Mining Co. The partners plan to treat custom ores in addition to regular mine output. Two sets of subleasers are active underground. Before the war as many as 20 sets of subleasers were active.

★ Greater United Mining Corporation, R. E. Williams, general manager and secretary-treasurer, is building a road into the New River area in Trinity County to develop commercial deposits of gold, copper, tungsten, and barite discovered by previous exploration. V. R. Hughes is president. Other officers include Louis Crosswhite, vice president; M. E. Williams, W. Fleming, and J. Reagan, attorney.

★ Several gold mines have resumed in Siskiyou County. Blue Ridge Midway Gold Mines Co. is working the Sugar Hill mine, near Callahan, with G. B. Hartley in charge. Norman Marvin, owner, is developing the Hansen group, on Knownothing Creek, tributary of the South Fork of Salmon River. Otis A. Sleep is reopening the Providence mine in the Oro Fino district. Harry Charles, a lessee, has installed a 10-stamp mill at the Morning Star mine, at Prospect Hill.

★ Encouraged by the results of sampling retimbered workings in the Gaston gold mine, at Washington, Nevada County, Tonopah Divide Mining Co., of Nevada, which has a long-term lease and purchase option, is planning to erect a 125- to 150-ton mill. A substantial tonnage of milling ore has been disclosed. The five veins average 5 ft. and better than $8 per ton in gold.

NEVADA

Equity tunnel, at Austin, has been reopened—Much drilling activity around Mountain City

★Newmont Mining Corporation's activities in Nevada are assuming major scope in two districts, at Goldfield and in the old Bullion or Railroad district in southern Elko County. Its Esmeralda operation, starting at Goldfield in 1944 with surface prospecting, geophysical work, and extended drilling to 400 ft. of the area a mile northwest

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Nevada (*continued*)

of the center of gold production, has been followed by reconditioning the old Silver Pick shaft to the 700-ft. level and installing a steel headframe, an electric hoist, and mine buildings, to permit drifting into the drilled area on the 700-ft. level. Fred Wise is in charge. Mine equipment has been delivered at lead-silver mines at Bullion that were productive in the 80's. Newmont also owns a substantial interest in Getchell Mine, Inc., largest producer of gold in Nevada before the war, now sinking a three-compartment shaft in new territory, its 1,500-ton cyanide mill still idle because of labor shortage.

★In east-central Elko County, near the Utah line, it is reported that a copper property 18 mi. south of Wendover, has been under development by Victoria Mines, Inc., said to be a unit of International Smelting & Refining Co. Development is said to center in a main shaft, provision being made to drive a long deep-level tunnel. A camp is being built for some 700 men, it is reported.

★Reports have indicated early action by the U. S. Bureau of Mines in exploring deposits containing uranium ore at Round Mountain, in Nye County. Samples were sent late last year to the State laboratory by John Heneberg and his brother, then driving a tunnel on a gold prospect. Tests proved the presence of uranium. Work in the tunnel has continued.

★Prospect drilling has been under way at several points in the Mountain City district, Elko County, following geophysical surveys along the broad copper belt, both east and west of the Anaconda-operated Rio Tinto mine. Amalgamated Development Co., organized to acquire ground east of the Rio Tinto, is said to have contracted for geophysical work and drilling. On the Rio Grande Copper Co. property five drill units were reported in operation, one by the U. S. Bureau of Mines. On the Mill Creek Copper Co.'s property an Idaho contractor has been drilling from surface and from the 380-ft. level of the 565-ft. shaft. West of the Rio Tinto, ground of the Mountain City Consolidated Copper Co., drilled last year by contract and by the U. S. Bureau, is being developed by crosscutting the ore zone from the inside shaft, 275 ft. below the level of the crosscut tunnel.

★At Austin, seat of Lander County and once a silver-mining center, the 1,700-ft. Equity tunnel, driven years ago, which cuts a series of veins that were productive at higher elevations on Lander Hill but never equipped for production, has been reopened and reconditioned throughout by Nevada Equity Mining Co., organized early this year and headed by officers of the Copper Canyon Mining Co.

★Eureka Hamburg Mining Co., with a large area of placer ground and two pilot washing plants at Leonard Creek, Humboldt County, has obtained mill and laboratory tests on its product, indicating that, in ground long worked by traditional placer methods, washing equipment recovers from 75c. to $1.50 per cubic yard, and at some points up to $2, but coarse crushing has given a higher recovery on $2 gravel. L. S. Fish, with office at Winnemucca, is head of the project.

UTAH

Hoover predicts world lead famine —Garfield smelter suffers minor fire damage.

★ A world lead famine was predicted by Herbert Hoover, former President of the United States, during a visit in Salt Lake City on Aug. 11, "unless the price is permitted to rise to a point permitting exploitation of low-grade deposits."

The renowned mining engineer said the world has plenty of copper but that the lead and zinc situation is less favorable. There has been no major lead-zinc development since Burma Mines at the turn of the century, he declared, except the solution of the geology of the Pioche, Nev., district, "which with its surrounding area bids fair to be the greatest lead district in the United States, since the intricacies of the lime beds and the quartzite have been solved after many years of research.

"I believe," he continued, "that if OPA were eliminated, the price of lead would reach 18c. a pound, a price necessary for mining low-grade ore."

★ Representatives of the International Union of Mine, Mill & Smelter Workers, CIO, from five Western states agreed on a resolution calling for an international union wage committee to draw up a program and policy "covering everything connected with bargaining in the entire organization" at a meeting held in Salt Lake City on Aug. 31. This was to be presented at the international convention beginning Sept. 16 in Cleveland, Ohio, said Dan Edwards, international board member from Utah and Nevada, in charge of the Salt Lake meeting.

★ Although the Park City properties of Park City Consolidated Mines Co. have been idle since August 1942, the Missouri operations enabled the company to pay off its RFC loan of $270,000, plus $20,282 interest and $105,000 balance on its Ruth property, at Fredericktown, Mo., according to the annual report. During 1945 the Missouri properties produced 6,683,573 lb. of lead, which brought $656,536 in smelter returns. In the first six months of 1946 the company produced 4,012,707 lb. of lead with metallurgical recovery of 96.56 percent.

★ The name of the Utah Metal Mine

(*Continued on page* 102)

(*Continued from page* 94)

covery of antimony as such varies from 60 to 70 percent, and the remainder exists mainly as sodium thioantimonite and a little as volatile trioxide. For the further extraction of the antimony from the sodium thioantimonite, a wet method or an electrolytic process must be devised; but such further processing complicates the whole procedure and is expensive.

To obviate such a complicated procedure of treating the resulting thioantimonite by any wet method or electrolytic process, the Germans adopted a rotary furnace for the smelting operation. The rotary movement enables oxidation of part of the antimony sulphide to the trioxide, thus releasing nascent sulphur dioxide which, in the presence of sodium carbonate, changes the obnoxious sodium sulphide to sodium thiosulphate, according to the reaction:

$$2\ Na_2S + SO_2 + Na_2CO_3 = 3\ Na_2S_2O_3 + CO_2$$

On further heating, the thiosulphate may be decomposed to Na_2S_5 which, however, in turn is oxidized back to the thiosulphate according to the following reactions:

$$4\ Na_2S_2O_3 = Na_2S_5 + 3\ Na_2SO_4$$
$$2\ Na_2S_5 + 3O_2 = 2\ Na_2S_2O_3 + 6S$$

Also, it is generally known that thioanthimonites of the alkali melt at low temperature and are fairly stable when gently heated out of contact with air, but when they are heated in air they will be converted into thioantimonate, Na_3SbS_4, which upon being further heated in air will be decomposed, resulting probably in the formation of the oxide and sulphide of antimony as well as of the thiosulphate of sodium, $Na_2S_2O_3$.

Further, the rotary movement may effect the formation of sodium carbonate through the oxidation of the sulphide of sodium in the presence of carbon, according to the following reaction:

$$2Na_2S + 2C + 5O_2 = 2Na_2CO_3 + 2SO_2$$

Thus, the so-called slag, as described in the article, is a complex mixture of alkaline silicate and some amount of undecomposed sodium thiosulphate and sodium sulphate, together with a certain amount of sodium thioantimonite and sodium thioantimonate. However, the antimony, present in the slag, exists probably and largely in the form of its sulphide and oxide.

Although this German method of smelting medium- or high-grade antimony ore entails the consumption of an inordinate amount of sodium carbonate, the recovery of antimony seems exceptionally high. The economy of this method, however, as compared with that of other well-established processes for smelting high-grade antimony ore, remains to be worked out.

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Utah *(continued)*

Operators' Association has been changed to Utah Mining Association because a less cumbersome title was desired.

★ Fire caused a three-hour shutdown of the world's largest copper smelter and did damage estimated at from $5,000 to $10,000 on Aug. 27 at the American Smelting & Refining Co. plant at Garfield. The blaze was confined to the "doghouse," a long building which houses steam pipes running from the boiler room to the power house, W. G. Rouillard, plant superintendent, said. Company firemen and two Salt Lake County fire department companies put out the blaze.

ARIZONA

Premium payments held exempt from State sales tax — Yuma County properties to reopen

★ Phelps Dodge Corporation, formerly third largest producer of copper, has moved into second place. The company's production of 360,581,000 lb., made possible through the operation of the Morenci mine, was second only to Kennecott in the domestic field. Miami Copper Co. ranks fourth and Inspiration Consolidated fifth.

Magma Copper's San Manuel deposit is reported to contain an average of 0.79 percent copper as well as small quantities of gold, silver, and molybdenum. The present Magma mine, at Superior, is given only six years of life, but the company plans erection of a new 1,500-ton mill and installation of new air-conditioning equipment to cost $1,750,000.

Kennecott Copper Corporation, the world's leading copper producer, is getting a large share of its production from the mines in Ray, Ariz.

In taking second place in copper production Phelps Dodge had to cope with a severe labor shortage. Officials stated that had it not been for this the corporation's combined output from Arizona properties would have far exceeded the amount produced. Phelps Dodge capacity is rated as 550,000,000 lb. of copper annually. The corporation has retired the final $9,529,100 of the $20,285,000 in debentures it issued in 1937 to develop the Morenci property.

★ Stockholders of Van Dyke Copper Co. are considering the sale of the firm's properties in Arizona to Anaconda Copper Mining Co. for a sum reported to be $5,000,000.

★ New machinery has been installed at the Desert Gold Mining & Milling Corporation, 55 mi. southwest of Tucson, according to A. L. Mace, general manager. At present the ore is being stockpiled awaiting replacement parts for the mill.

★ Shattuck Denn Mining Corporation

has announced it will liquidate its holdings in Bisbee, and that negotiations with Phelps Dodge were conducted in New York during the past few months concerning the proposed plans.

★Rio del Monte Mines, Inc., which owns mining properties in Yuma County, near Salome, will resume active operation of mines in the district as soon as legal phases are completed. A number of former producers are included in the company's properties. The head office will be in Yuma.

★Payments of premiums or subsidies by the Federal Government to Arizona mining companies should not be taxed under the State sales tax law, according to a recent ruling by Attorney General John L. Sullivan. The opinion was in response to a question from the State Tax Commission. Under the Sales Tax Act the levy is on the gross income of mining concerns. However, the Sullivan decision pointed out that the premiums or subsidies do not increase the market price of metals, but are paid by the Government to stimulate production and make it possible for marginal producers to operate.

★The $35,000,000 Phoenix aluminum plant, declared surplus after the war, will soon return to operation. Reynolds will bring raw material to the plant from throughout the nation, and the first smelt is expected within two months.

COLORADO

Spiral concentrator finding new users—Future uncertain for Leadville drainage tunnel

★Ore & Chemical Co.'s heavy-media separation plant, at Leadville, reopened only a couple of weeks previously after a shutdown during the price holiday, was closed permanently late in August. Declining quality of ore dumps, increased milling and other costs, and higher wages and freight charges all militated against operating at a profit, according to Kurt Spohr, manager. The building is boarded up and the machinery has been stored. The plant began operations July 25, 1943, and contributed many thousand tons of concentrates to the war effort. Mine dump ores from the R.A.M. Tucson, North Moyer, Robert Emmett, and Mab dumps were treated.

The plant had been shut down earlier in the year during the smelter strike, and again in July when premiums went off. It had reopened on Aug. 1. From 40 to 50 men are employed.

★H. L. Tedrow and Walter Scott, for Gold Mines Consolidated, Inc., are developing the old Terrible-Dunderberg properties at Silver Plume with George Rowe as superintendent in

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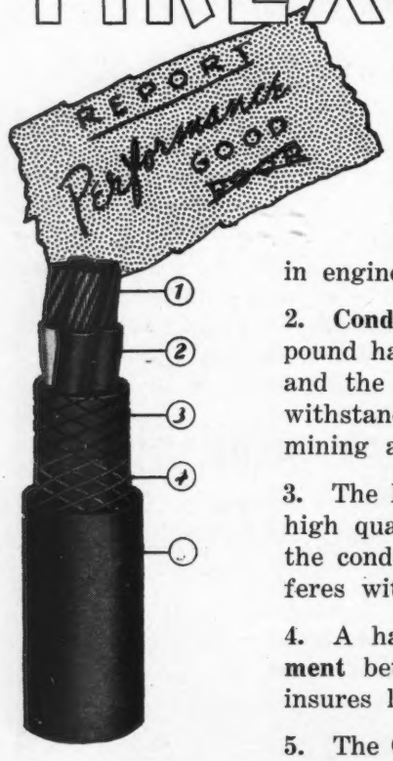

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Colorado (*Continued*)

charge. The mine has been unwatered and completely retimbered, and the shaft and main tunnel have been restored. The old steam hoist has been electrified, and most of the old levels have been reopened. Considerable ore has been found, either broken up or accessible at the top or bottom of some levels. That assayed so far runs about 15 oz. silver, with high lead and zinc. Milling plans are still unsettled. They may build a mill, or ship.

★The Humphreys spiral concentrator, first described to the industry in detail in *E.&M.J.* for March 1945, is now in use in three large installations and a third is being prepared. Pacific Bridge Co., Park City, Utah, is treating 1,500 tons daily of tailings for a former lead-zinc-silver milling operation. About 1,100 tons per day are discarded by 48 spirals, before differential flotation separation of zinc and lead. Also—its first use in coal—an anthracite washing plant is being installed in Pennsylvania to wash 50 tons per day of anthracite silt for use in a colliery power plant. This project will use 36 spirals in all. Meanwhile, Humphreys Gold Corporation has increased the capacity of its sand-washing plant in Florida (for recovery of ilmenite, rutile, and zircon) to 7,500 tons daily from the 2,000 tons daily originally described by *E.&M.J.* There are 316 spirals in all at this plant. Numerous single and double units have been sold for test purposes.

★The next convention under auspices of the Colorado Mining Association will be held in Denver on Feb. 6, 7, and 8, 1947. As usual it will cover far more ground than Colorado, and leaders of mining and public affairs throughout the West and the nation will be present, according to its secretary, Robert S. Palmer. Mr. Palmer, Charles N. Bell, past president, and H. L. Tedrow, president, have been added to the Board of Governors of the American Mining Congress.

★John H. Snyder, operator of fluorspar properties at Grants, N. M., has taken a lease with associates on a group of claims on Mt. Bross near Alma. Ed Moynahan, of Denver and Alma, is engineer in charge. The work so far is in the nature of open-pit work, and includes exploration to establish values, though some ores are being shipped. Should values hold up as expected, the company may build a mill in 1947.

★The huge crater opened up by a cave-in at the Cresson mine, in Cripple Creek, late in July has been filled, a job taking nearly two months. Progress was hampered by heavy rains, which caved the crater further and at one time widened it to about 150 ft. across, as compared to the original 100 ft. No further damage to underground workings was done. But part of the storehouse dropped into the hole, as did the cement floor on which the steel shop formerly stood.

The cave has been filled with surface muck by a dragline to protect the shaft.

Meanwhile another cave-in just north of the Independence mine, in Victor, was caused by heavy rains. The hole extended to the "A" level of the Independence. It did no damage to mining properties.

★Jack Downs, of Denver and Idaho Springs, has leased for 10 years the Lexington group of claims two and one-half miles south of Idaho Springs, which he plans to work through a tunnel in Warren Gulch. The five claims have not been worked, so far as is known, since 1897, although some 20 years ago a tunnel was started from Warren Gulch to undercut the shaft. This tunnel is 125 ft. short of undercutting and 100 feet below the shaft. Downs and associates are building a road to bring in equipment, including a compressor.

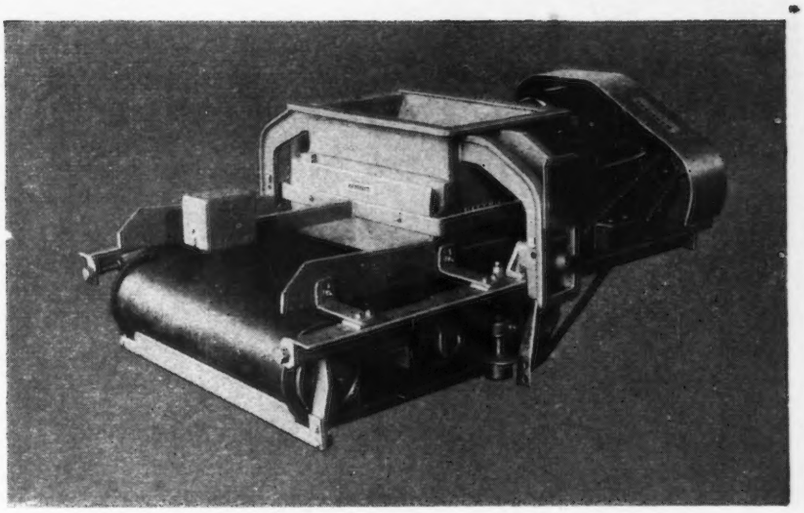
★Lead Carbonate Mines, Silverton, mined and shipped 621 tons of crude ore to custom mills in July and August, netting approximately $9,315. The property was recently acquired on a lease and option basis by H. P. Ehrlinger, J. E. Archibald, and F. R. Archibald, who are, respectively, president, vice president and general manager, and secretary-treasurer of the company. The mine produces an exceptionally clean-milling sulphide ore which is highly amenable to flotation. The company plans to carry on development work as far into the winter as possible and, if sufficient ore is blocked out, to construct a mill next spring. It is expected that mill recovery will average $10 to $12 per ton.

★Carter Mines, Inc., has announced completion of the 100-ton milling plant recently under construction at the Carter mine near Ohio City, Gunnison County. The installation includes a 6x6 ft. Allis Chalmers ball mill, mineral jig, flotation cells, and thickener and filter units. An ultimate capacity of 125 tons of ore a day is contemplated. The Carter mine was acquired by the present company in April, 1946. H. D. Tudor is president of Carter Mines; S. F. Wickham is general superintendent with headquarters at Salida; and Ray McDonald is superintendent in charge of operations at Ohio City.

TRI-STATE

Recent strike at Henryetta smelter costly to men—CIO chosen by E-P surface workers

★Representing the Tri-State mining industry at the Denver meeting of the American Mining Congress last month were O. W. Bilharz, Victor Rakowsky, M. C. Bagby, Robert Cash, Carrol Copps, S. S. Clarke, Howard Childress, Jack Dunlop, F. W. (Mike) Evans, Robert Fulton, George M. Fowler, W. H. Freudenberg, Hamilton A. Gray, Howard O. Gray, Elmer



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Tri-State *(Continued)*

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★Sale of the Mary Ann mine, northeast of Picher, to Scott Mining Co. late in August has been announced by John Reigart, of Baxter Springs, operator of the property since July 1943. The mine lease, which was originally developed by the old Commerce Mining & Royalty Co., comprised approximately 70 acres of the northwest portion of the old Mary Ann property, owned by the Scott interests. It included about 50 acres on which the Mary Ann was situated and 20 acres of the old Golden Eagle, adjoining the former on the south. During his operation of the mine, Reigart trucked the ore to Eagle-Picher's Central mill. It is expected the ore will now be shifted to the Scott mill, east of Hockerville.

★Evans-Wallower Zinc, Inc., has completed its new shaft on the No. 4 lease, known as No. 16 mine, according to Floyd W. Gooch, of Joplin. The shaft, situated near the intersection of Connell Ave. and the east Cardin Road, south of Picher, is being opened up on the 165-ft. level, where good runs of zinc and lead have proved out in line with previous churn-drill records. Across the north-south roadway to the east, the Marcia K. Mining Co., successors to the old Lawyers Lead & Zinc Co., have started a new shaft for improved ventilation in the company's development of the old Birthday mine. The Marcia K. company has been expanding its operations on both the Thomas Buffalo and Buffalo Calf leases, which were acquired from the Lawyers company. Claude Jones, who heads the company, is directing the expansion program.

★In an NLRB election held Aug. 15 and 16, surface workers, including Central mill employees, of the Eagle-Picher Mining & Smelting Co. voted 232 to 113 to have the International Union of Mine, Mill & Smelter Workers (CIO) to serve as their bargaining agent. Howard Lee, representing the international union, pointed to the significance of the result "in that it gives the union tremendous bargaining power and portends the complete organization of the Tri-State." He said that within a few weeks attempts will be made to organize Eagle-Picher underground workers of the district mining field, which would involve about 800 underground miners.

★John A. Skinner, of Webb City, was named general manager of St. Louis Mining & Milling Corp. at a recent meeting of the directors, according to E. B. Meissner, of St. Louis, president. Clyde Isaacs, of Joplin, was elected assistant treasurer. Other officers besides Meissner, who also continues as treasurer, include Edwin B. Meissner, Jr., who is vice president and secretary. Resignation of B. D. Bensing, formerly assistant to the president, was announced. Skinner, former Missouri chief mine inspector, will be in charge of operations, including its custom mill and several mining projects on its 1,000-acre property at Thoms Station, northwest of Joplin, and will continue to look after operations of the Wentworth Mining & Milling Co. near Wentworth. Isaacs will assist Skinner in the operation of both companies.

★In a letter Sept. 13 to employees of Eagle-Picher's zinc smelter at Henryetta, Okla., E. C. Mabon, of Joplin, personnel director for the firm, pointed out that the company's plant maintenance cost during the recent strike was $101,870. Had the 600 employees at the plant accepted the company's offer made before the strike, which lasted 157 days, they would have received $623,301 in wages, if they had worked during the period, Mabon said. It will require 694 weeks, or more than 13 years of steady work by each individual employee to recover his loss in wages during the strike, he said. Mabon also pointed out that this money in circulation in Henryetta would have benefited many people, but as the plant was idle, it benefits no one. "Another possible loss to all of us is that the plant may have to be closed because of the additional operational costs, including labor and supplies, both of which increased approximately 20 percent," Mabon said. "We hope to get an increase in the price of zinc in the future to offset the increased costs, but increased efficiency is necessary to keep the plant going. Its closing would be an even greater loss to all of us."

MISSOURI

Housing needs at Rolla hold registration up. DeSoto gets old barite property

★Registration at the Missouri School of Mines, at Rolla, was delayed two weeks to allow the construction of emergency houses for students and faculty. More than 2,000 students have registered, which exceeds twice the number of any previous enrollment. Included in the emergency housing project were 13 barracks-style buildings housing 16 men each, a large 65-man dormitory, 7 apartment buildings with eight 4-room apartments in each, and five duplex houses.

★Consolidation of three departments into one, under the direction of Prof. H. S. Lloyd, and to be known as the Department of Humanities and Social

Studies, has been approved by the University Board. The new department will offer courses in English, economics, history, sociology, psychology, and foreign languages. The purpose is to render more effective the recommendation of a committee of engineering educators made in 1940 concerning postwar engineering education. Professor Lloyd, who has been on the faculty since 1921 and head of the department of economics since 1938, stated that the primary objective of the new department would be to develop the ability of the engineering student to read, write, and speak the English language effectively; to give him a knowledge of human social relationships and an understanding of the duty of citizenship; and an appreciation of the cultural interests outside the field of engineering.

★DeSoto Mining Co., DeSoto, Mo., has taken over the old Hannenkratt barite property, in Camden County, in the central Missouri district. It is operating also two barite properties near Richwoods, Washington County. J. Thompson, of DeSoto, is manager.

★Fredericktown Lead Co. is churn-drilling for lead on the Catharine and Fleming tracts in the Fredericktown district.

ARKANSAS

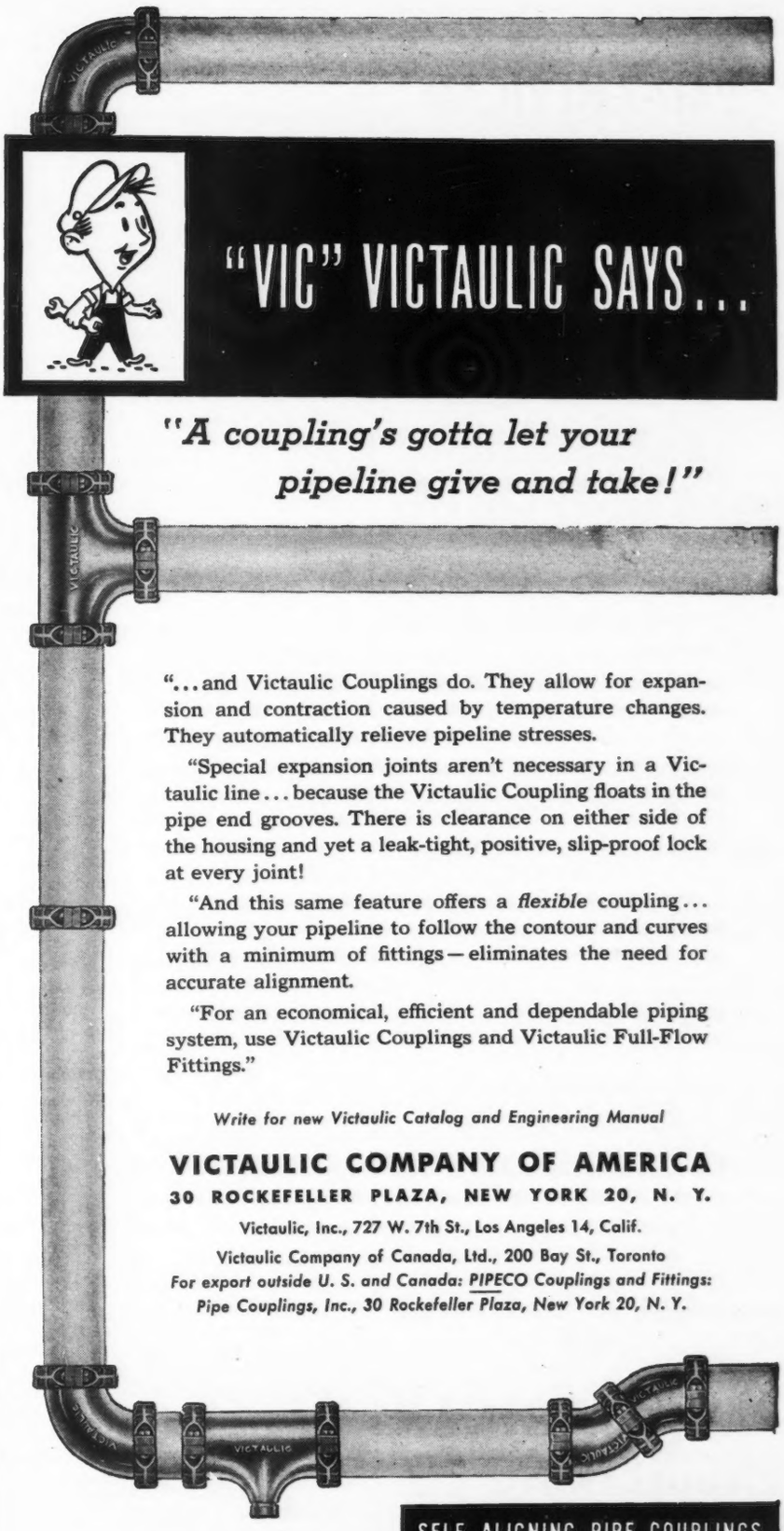
Manganese mining lags — Good tonnage of zinc ore found in Mine 16

★The Batesville-Cushman manganese field could boast just one producer during August—namely, the Walter H. Denison Manganese Co. Reed Denison is in charge. Their August output was 51 tons of high-grade ore, and 107 tons of low-grade. They expect to have a market for low-grade for the rest of the year.

★S. & G., Inc., which is operating the Hurricane mine, near Pindall, in Searcy County, shipped one car of high-grade carbonate ore in August. Development work at the bottom of the St. Joe fault is showing such ore, but it is not available yet.

★Ed Zimmerman, in charge of operations at the Maumee mine, in Searcy County, for the Bank of Farmington, Farmington, Mo., has reached the 100-ft. level and is mining a high-grade zinc sulphide. He will sink the shaft to 110 ft. A new pump is being installed to take care of increasing water.

★Big Hurricane zinc mine, in Searcy County, has suspended milling operations pending a possible diamond-drilling exploration program to attempt to prove up additional ore reserves. Tom Grimmet, of Harrison, is in charge of the mine.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IRON COUNTRY

Cleveland-Cliffs sells wood-working plants and sawmills to Dearborn Company

★That the activities of Cleveland-Cliffs Iron Co. are being confined more to the production of iron ore is shown by the fact that its timber department was disposed of for the sum of $2,000,000 cash to the Dearborn Company, a Chicago firm. This sale included the wood-working plants at Munising and Marquette and the two sawmills in Munising. The timber lands are retained by Cleveland-Cliffs which will supply the lumber for the mills for the next ten years at least. Dearborn now owns five plants, two in Oshkosh, Wis., one in Escanaba, one in Marquette, and one in Munising.

★Bethlehem Steel officials visited the iron ranges of Minnesota and Michigan during the first part of September. Arthur B. Homer, president; Norborne Berkeley, vice president, and M. L. Jacobs, vice president in charge of raw materials, inspected the iron-ore interests of the company. Also in the group were Elton Hoyt, 2d, and Howard Prescott, of the Cleveland offices of Pickands, Mather & Co.; A. D. Chisholm, general manager, and L. C. David and John C. Metcalf, assistant managers, of P-M's Duluth offices.

★The increase of 15c. in freight rates on iron ore is being opposed by the State of Minnesota. Such an increase, it is feared, would tend to slow up the efforts to develop low-grade ores and would encourage mining companies to migrate to other fields. Butler Brothers, one of the largest independent mining companies, already had filed a petition with the Interstate Commerce Commission asking for a cut in freight rates on low-grade ores. It contends that iron-ore freight rates have in the past yielded excessive returns on the investment of the companies engaged in transporting iron ore.

★Miners of International Harvester Co. on the Mesabi Range who struck Feb. 7 last are still out. No agreement was reached last month when the mining company met with the representatives of the United Steelworkers (CIO) in Washington, D. C.

MICHIGAN

Reopening of Champion mine is under study — Operations at Gratiot make headway

★Calumet & Hecla Consolidated Copper Co.'s experience with diversified types of copper scrap has led to development of numerous treatment processes whereby undesirable impurities in or associated with scrap are separated from the copper, leaving the metal in a form suitable for direct smelting into high-conductivity commercial grades. The increasing use of such methods has made it possible for the company's secondary department to purchase and handle larger and larger tonnages of materials previously not considered desirable for treatment at the smelter. These processes are delivering millions of pounds of copper to the furnaces.

The latest addition to this group of processes is one which makes it possible to treat "copper mud," a waste product resulting from the drawing of copper wire. The material as received is a pasty mixture of fine copper, oil, grease, and floor sweepings, having an average copper content of 25 percent and a combination of animal, vegetable, and mineral oils of approximately 40 percent. As received, it is not suitable for direct furnacing, due to the high percentage of fat and water, but after months of experimenting, a procedure was worked out which recovers the copper in a highly concentrated, useful form and the fat byproducts as well.

The processing includes a large lead-lined digester, filters, grease-accumulation tanks, copper-recovery tank, and a 10,000-gal. storage tank for grease. Installation work was started in June and production on a limited basis began in mid-August. The unit is operating continuously. The copper thus recovered runs approximately 75 percent metal and is suitable for direct furnacing with other concentrates. The fat is reclaimed as a semi-clear liquid and is accumulated in 8,000 to 10,000-gal. batches (40,000 to 60,000 lb.) for shipment in tank cars.

★Underground operations have been resumed in Calumet & Hecla's No. 2 Gratiot shaft, with three crews. Repairs are being made to the shaft, and actual mining will get under way soon. The property, formerly part of Seneca Mining Co. holdings, is under the supervision of Ocha Potter, superintendent of Ahmeek mine. The company is drifting north from the 30th level, No. 4 Ahmeek, and will raise from this drift to the bottom of No. 2 Gratiot. Exploration of Gratiot territory will be made from this point.

The temporary engine house at Gratiot has been completed, the rope put on the hoist drum, and the engine is in operation; likewise the compressor. Forms are being placed for the concrete for the engine and engine house foundations. The large Nordberg hoist formerly used at No. 13 shaft, Osceola amygdaloid, will be set up at Gratiot. It will operate 8-ton skips in balance.

★In accordance with the recent action of Calumet & Hecla directors, declaring a 10c. per share dividend, the usual bonus equivalent to the dividend on 50 shares of stock will be paid on

the last September pay day to employees on record as of Aug. 31, 1946. The directors have voted to abolish the office of chairman.

★Copper Range Co. is conducting mine and mill tests and making an exhaustive study of all phases to ascertain whether the Champion mine can be economically reopened on a limited tonnage basis, according to an official announcement. The mine has been closed since September 1945.

★Addressing the American Mining Congress in Denver, Colo., on Sept. 10, E. R. Lovell, president of Calumet & Hecla, speaking as a representative of the Michigan copper industry, said in part:

"We strongly favor stockpiling. We are definitely of the opinion that the tariff on copper should be retained and administered intelligently without relation to political considerations. We strenuously urge the adoption of a simple plan for payment of subsidies to marginal copper producers. All of these instrumentalities are absolutely essential if we are to maintain a healthy mining industry, furnish incentive for future exploration and development of new mines, and, above all, provide for the security of the nation."

He said further, "We must accumulate a supply of copper dedicated solely to use during the initial stage of a war, to be utilized while production is being shifted from peacetime uses, and at the same time, expanded for the requirements of war.

"Metal subsidies," he said, "are a method of achieving the conservation of our natural resources and of assuring adequate materials for national defense. Market prices should be high enough so that subsidies are necessary only for the 'fringe' of high-cost mines.

"The copper tariff," Mr. Lovell declared, "is necessary if our low-grade reserves are to be realized upon as a national resource in an emergency. It must be considered from a long-range point of view, and should not be adjusted for short-term variations."

ALABAMA

T.C.I. & R. president outlines expansion — Calumet & Hecla to build fabricating plant

★Robert Gregg, president of Tennessee Coal, Iron & Railroad Co., predicts a vast expansion and diversification of industry in Alabama and the South in the near future "because this section has become a market center, and industry always follows the markets."

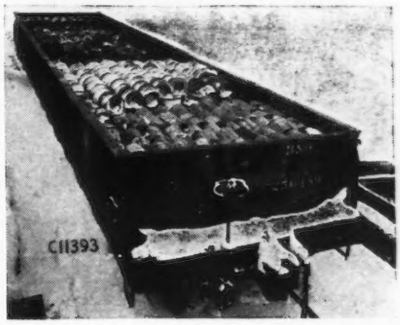
Speaking before the Bessemer Kiwanis Club, Mr. Gregg reviewed the part played by his company in the growth and development of the South and said that for years TCI has sponsored a program among the farmers designed to provide better markets

Winning Gold with Hydraulic Elevators Definitely Calls for Manganese Steel

Empire Hydraulic Gravel Elevators, made by the New York Engineering Co., have made many placer mines profitable that might otherwise have been non-productive today. These include operations where it is not practical to excavate the gravel in the usual manner with a bucket-line dredge.

The wear and tear on a hydraulic elevator, with the gravel and water traveling at high speed, is very great. The liners must afford sturdy resistance to shocks and abrasive wear if frequent replacements, operating delays and excessive costs are to be avoided. In the early days, white iron castings were used for liners, but they did not have what it takes. Rubber linings were tried and discarded.

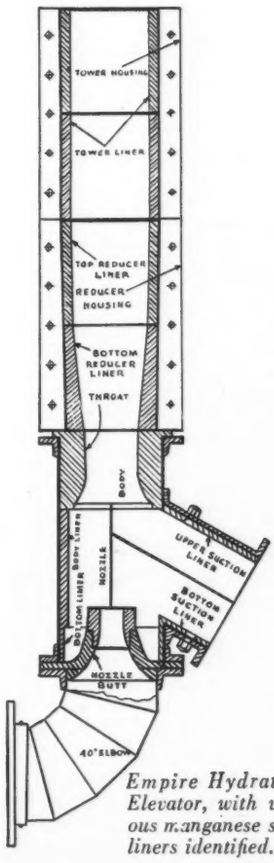
One of the reasons for the fine reputation enjoyed by Empire elevators is the employment of austenitic manganese steel, which in all dredging operations has proved the most long-lived and economical metal at points of abrasion and stress.



C-11393. A carload — 50 tons — of Amsco manganese steel throat, cylinder and body liners for hydraulic elevators.

In the sketch of the Empire Hydraulic Elevator, various manganese steel liners are identified. Picture C-11393 shows a carload—50 tons—of Amsco manganese steel throat, cylinder and body liners made at our Denver plant. Empire elevators are made so that they can be readily repaired and worn parts replaced with minimum trouble.

Applications of Amsco Manganese Steel to all types of dredging equipment are shown in Bulletin 844-D.



Empire Hydraulic Elevator, with various manganese steel liners identified.

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HEAVY POWER EQUIPMENT plays a leading part in moving large quantities of material in the open-pit mining of phosphate at the Phosphate Mining Co., a subsidiary of Virginia-Carolina Chemical Corporation, near Bartow, Fla. An International D-18 diesel crawler is shown doing the preliminary work of knocking down trees and brush and bulldozing them into piles for burning. Overburden averaging 20 ft. thick is then removed by the Bucyrus Erie dragline with 9-cu.yd. bucket, seen in the background, which is also used to mine the phosphate matrix varying from 3 to 19 ft. in thickness. This material is piled near a sump, worked down by hydraulic guns moving 500 cu.yd. of solids an hour, and centrifugally pumped to a washing and sizing plant 4,000 ft. away.

Alabama (*Continued*)

and marketing practices. Any improvement in the economic conditions of farmers, he said, serves to create new markets for steel products.

Even though TCI had been at full production capacity since September 1939, said Mr. Gregg, and had "not lost anytime of its own volition, it had been unable to meet demands for steel products."

The company now is building one of the largest open-hearth furnaces in the South, which, when completed next February, will add 120,000 tons of ingot-steel production yearly.

★A program to substitute diesel-electric locomotives for the steam locomotives now employed in switching freight traffic between TCI's plants and mines has been initiated by Tennessee Coal, Iron & Railroad Co. Twelve diesels are being operated. The company will replace the present 33 steam units and add others to give a total of 39. The program will be completed by 1949. A modern diesel-repair shop at Pratt City, Ala., easily accessible to mines and plants in the Birmingham district, is being built. It replaces the now obsolete steam-locomotive repair shop.

★Sloss-Sheffield Steel & Iron Co., Birmingham, is putting in a heavy-media separation plant at Russellville to handle the brown ore from the open-cut mines there. Five 15-ton diesel trucks are to be put into service to haul ore over specially built roads from the mines. It is expected that the new plant, the first of its kind to be built in the South, will be ready by January. The cost will be about $200,000.

The company is now operating at capacity on pig iron, and from the indicated demand sees no change in maximum operation.

★Calumet & Hecla Consolidated Copper Corp., of Michigan, has announced that a new fabricating plant will be built at Decatur, Ala., when permits can be obtained and that it will make tubing and allied products of copper, copper-base alloys, and aluminum. Its output will augment that of the company's Wolverine Tube division in Detroit, Mich., where capacity cannot be expanded because of lack of space. Decatur was selected because of the availability of natural gas and low-cost power from T.V.A.

FLORIDA

International's Achan phosphate mine in production — Noralyn plant to start in 1947

★Continuous demand for all the phosphate rock that could be produced is reported by International Minerals Chemical Corporation for the last fiscal year. The company expects production to continue at a high rate for several years, thanks to large domestic requirements and to resumption of sales to foreign countries. Installation of the huge 25-cu. yd. Bucyrus-Monighan walking dragline, which started work Jan. 1 last at the

Peace Valley mine, has increased the output and improved the efficiencies at that property. At the Noralyn mine, which is to be opened on the high-grade property acquired near Bartow, the new modern 1,000,000-ton plant is scheduled to start operating in 1947. Another dragline has been purchased for this mine. Construction of the new but smaller plant at the Achan mine, at Mulberry, was started this spring and finished in August. Four speed reducers, which were all that was lacking to get the Achan unit into production, were rushed dramatically by plane from Chicago to Mulberry. This property will replace the "122" mine, which will be exhausted soon. The International is currently the largest producer of phosphate in Florida.

ILLINOIS and KENTUCKY

Inland fluorspar employees get additional pay increase

★ Effective Aug. 1, employees of the Inland Steel Co.'s fluorspar division at Rosiclare, Ill., were granted an 8½c. hourly wage increase, according to company announcement. Operation is on a 40-hour week basis. The recent raise, which applies to hourly rated employees in all classifications, follows a 10c. per hour increase on June 1.

★ Mineral rights in a 40-acre tract, in the eastern section of Hardin County, Ill., have been purchased by Alco Corporation, an Illinois company operated by Evansville, Ind., interests. The purchase price was $10,000. Rights to fluorspar, lead, zinc, and all minerals, excluding oil and gas, were embraced in the transaction.

ALASKA

Gold operators want more for metal because of higher costs—Gold production is lagging

★The Alaska Juneau mine is still shut down. Officials say they can not operate without lower costs or an increase in the gold price. They say labor accounts for 70 percent of mining costs. The mine which normally employed 1,000 men has a standby maintenance crew of about 40.

★Walter Johnson, dredge builder and operator of San Francisco, said in Fairbanks, after visiting three of his Alaskan properties, that Alaska's gold production is lagging and that operators must receive more for their gold. His Caribou Creek dredge and a hydraulic operation on Slate Creek, in the Chistochina area, are in opera-

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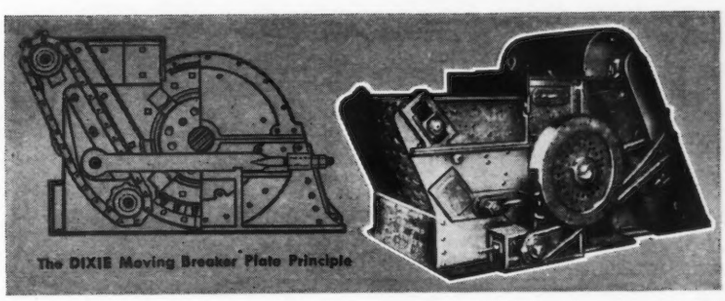
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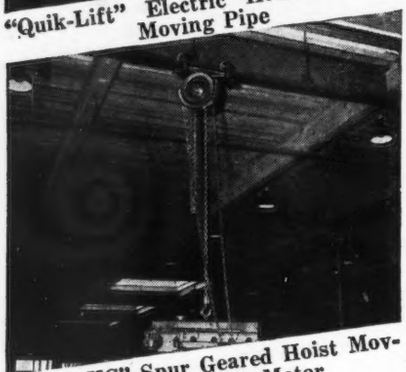

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Alaska *(Continued)*

tion this year. He said, "There is a serious labor shortage, and mining operators are handicapped because government contractors pay a higher scale. The miner sells his gold at a price fixed in 1933, although operating costs have mounted steadily for a number of years."

★Walter W. Johnson Dredging Co., of San Francisco, is doing exploratory work on the Salmon River, near Hyder. A test hole struck bedrock at 5 ft., and if the gravel yields as much as 30c. a yard, extensive work will be continued there next spring. A number of Hyder residents hold leases estimated to run from $50,000 to $100,000 each on the river properties.

★A party from the U. S. Geological Survey's office have been studying the garnet field, near Wrangell, this summer, in order to map the area and find out how wide a field the garnets cover. The stones are used in making fine sandpaper.

★According to Marshall Stringer, inspector for Livengood Placers, Lytle & Green Construction Co., contractors, have finished the Livengood dam, which was started before the war.

★Exploration work is being done on Porcupine Creek, near Wiseman, by Jack McCord and Jurgen Frederickson. They acquired the property in 1946.

★Work will be resumed as soon as men can be secured at the Blue Jay mine, on Helm Bay, 28 miles from Ketchikan, according to Bert Libe, owner since 1938. He has 450 ft. of tunnels.

★Thirteen mines were brought into production in Alaska as a result of assistance rendered by the U. S. Bureau of Mines in exploration projects and preliminary examinations during the war, according to Robert Sanford, chief of the Alaska division of the Bureau. He has announced that reports on some 19 mineral deposits in the Territory are now available at the Juneau office, free of charge.

CANADA

Labor shortage reported at its worst since 1939 — Exploration active in Groundhog River area

★ A demonstration was given in Canada in September of the airborne magnetometer developed by the U. S. Geological Survey. The tests, made at the request of the National Council and the Department of Mines and Resources, showed how the highly sensitive instrument was towed by a plane flying 150 miles an hour suspending the magnetometer at an elevation of about 1,000 ft. A graph placed in the cabin of the plane gave a continuous recording of magnetic readings and altitude. A simultaneous record of the flight was made by a camera gyroscopically controlled. Information so secured makes possible the construction of a map showing magnetic contours along the flight path.

★ Construction of new roads is reported to be progressing in Quebec and Ontario. The 100-mile road from the railway to Red Lake and the 25-mile road east from Matheson to the Lightning River district on the Quebec boundary are scheduled to be completed before Jan. 1 next. The 130-mile road to connect the Chibougamau district with Lake St. John and the railway is to be completed next year.

★ The Ontario Hydro Electric Power Commission is advancing construction of new lines in mining districts as fast as material shortages will allow. In the Porcupine area the voltage is being raised from 12,000 to 26,000 as part of the program that will cost $1,500,000. An additional 7,500-hp. unit is being installed at Ear Falls to make 25,000 hp. available for the Red Lake and Patricia districts. A second high-tension line is being built to Red Lake, where power contracts have been signed by nine new mines. Before the end of 1948 an additional 55,000 hp. is to be under development in the Nipigon district to supplement the 129,000 hp. now available. This power will supply the district that includes the Steep Rock area, the Little Long Lac camp, Beardmore, and Geraldton. Adequate power is now being delivered throughout the Sudbury district, which includes the Groundhog River area, the scene of Ontario's major gold rush in many years.

★ Labor shortage is reported to be more serious now in Canadian mines than at any time since 1939, the Aunor mine, in Ontario, being the only producer shown by a recent survey to have an adequate crew. Many plants are said to be operating at a third to a quarter of capacity, with resulting increased costs. More men would make it possible to enlarge the scale of production and reduce the cost per ton. An emphasis on development is now being made at many mines where there was no attempt in the war years to do exploration and block out new tonnage. Few men have yet returned to the camps from industrial centers to the south where they went during the war.

★ The index of mining production was slightly lower in July than in June, according to a report released on Sept. 10 by the Dominion Bureau of Statistics. Due to the dislocation caused by strikes, manufacturing also showed a minor recession, but industrial production in Canada as a whole moved up nearly 1 percent to 180.3.

QUEBEC

★ Aluminum Company of Canada agreed Sept. 11 with the National Syndicate of Aluminum Workers, of Arvida, to make joint application to

the Quebec regional War Labor Board for approval of wage increases of from 5 to 14c. an hour, retroactive to Aug. 16. An agreement was also reached on other modifications of the collective labor contract not involving wages.

★ Growth of Val d'Or from a group of cabins in 1936 to the present town of many modern buildings and 8,000 population was discussed there recently by the mayor, J. E. Berard, before 160 visiting Montreal business men. Closer relations between Montreal and the mining area of the province was asked by Andrew Robertson, representing the Northwestern Quebec Mining Association. Frank Willcox, mining executive and head of the mines and natural resources section of the Montreal Board of Trade, stated: "We are alive to your problems; we are here to help." Support by the provincial government in furthering the interests of the industry was promised by Jonathan Robinson, Quebec Minister of Mines.

☆ At East Malartic Mines acute labor shortage has caused loss of production since June compared with the output for the first half year, which was better than any time since 1944. In September only 800 tons a day was being put through the 1,800-ton mill. No new level has been brought into production for five years, due to the problem of finding miners. Sinking the new incline shaft below the tenth level is to be completed to the 16th level in about six months. The present objective of 2,470 ft. is to be extended later to a depth of 4,000 ft. A continuous length of 1,200 ft. is reported for the main orebody, which varies in width from 15 to 80 ft. and has been developed down to the bottom or 10th level without change. D. M. MacLean is mine manager and Andrew J. Davis president.

★ E. A. Goranson, manager of Norbenite Malartic Mines, has reported that the 43-ft. concrete caisson has been completed for the three-compartment shaft that is to be put down to 500 ft. depth. The power line and road to the property have been completed and all heavy equipment has been delivered except transformers. Diamond drilling had indicated several large orebodies, of which the north zone was shown to have 500,000 tons of $6.26 ore above the 300 horizon, averaging 23.3 ft. in width.

★ The shaft at East Amphi Gold Mines had reached a 350-ft. depth in September and the final 100 ft. was expected to be completed within a month. The ore zone, located about 550 ft. from the shaft, is to be developed from levels at the 325 and 475 horizons. Control of East Amphi is held by Howey, Pioneer, Coniagas, Northern Canada Mines, Cyril Knight Prospecting Co., and Prospectors Airways. J. Bradley Streit is president.

★ Gustave Maher, resident engineer at Louvicourt Goldfield Corporation,

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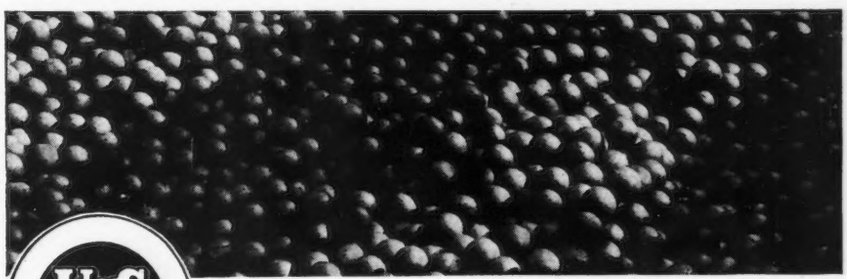

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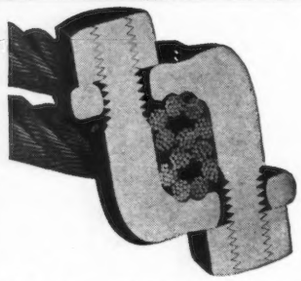

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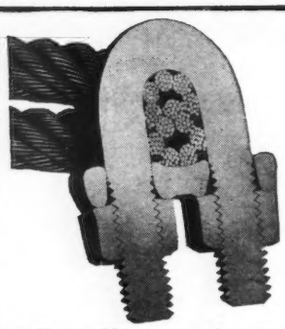

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Canada *(continued)*

is in charge of the extensive construction work and underground development underway. Shaft sinking is being continued to 750 ft. depth, and work is being rushed to complete the mill so as to start production by the end of January. The initial rate is to be 400 tons a day, to be increased above 600. Diamond drilling which traced the zone for 800 ft., indicated an average grade of $6 a ton, which, it is expected, will be increased by underground work. Overall costs are put at $4.50 a ton. The shaft vein and two other ore sections so far exposed by preliminary exploration show values erratically distributed but of much higher grade than was indicated by the drill holes. G. H. Dumont is mine manager and Pierre Beauchemin is president.

ONTARIO

★ Dominion Nickel Mining Corporation resumed diamond drilling in August on the property in Norman Township. It has been proposed to build a concentrator on the strength of the 1944 drilling results. Clyde V. Shoemaker is president and managing director.

★ W. G. Watkins, mine manager at the Moose Lake mine of Ontario Nickel Mines, reports that underground exploration and diamond drilling have made important additions to the orebody. The new south drift in the hanging wall has given locations for drilling at 100-ft. intervals to test the continuation of the ore structure at 550 ft. depth. Recent drilling at the 300-ft. horizon showed a section averaging 1.68 percent nickel and 0.42 percent copper across 40 ft. Hole 26 on the south vein returned two sections of 9 and 64 ft. in which 3.03 percent and 2.06 percent nickel were disclosed. J. H. Adams is president.

★ Work is progressing in the Groundhog River area, Keith Township, where Joburke Gold Mines, Pen-Rey, and other operators are rushing exploration before the freeze-up. A road has been cut from the railway and several camps have been built. D. M. Giachino is acting as resident engineer for Chamberlin Management Corporation, consultants for Pen-Rey.

★ The new shaft at Pamour Gold Mines reached a depth of 800 ft. in September, its objective being 1,400 ft. Lateral development will follow completion of sinking. This program will explore the ore indicated in the west section, which appears to be of better grade though of smaller widths than in the east part of the mine. The west section is believed to be the downward extension of the Broulan orebody and attains a length of 1,000 to 1,600 ft. C. E. Anderson is mine manager and J. Y. Murdoch is president.

MANITOBA

★ Sherritt Gordon reports for the second quarter earnings of $154,408, a drop of $117,257. Whereas 5,478,186 lb. of copper was produced during this period, only 4,566,538 lb. was marketed. Tonnage milled was 148,180, from which were produced in addition to copper 5,119 tons of zinc concentrates, 1,568 oz. gold, and 53,318 oz. silver.

Two of the company's prospecting parties have made a new gold discovery, 25 miles east of the Lynn Lake nickel-copper occurrence. Some 150 claims have been staked in what is known as the Farley Lake area. Initial drilling has yielded intersections of 0.18 oz. across 17.5 ft. and 0.42 oz. across 10.7 ft.

At Lynn Lake plans have been completed for shaft sinking, and a large part of the necessary supplies are now on the property. Three drills operating on the "A," "E," and "C" anomalies continue to yield new intersections. Hole 87, vertical and located 50 ft. west of Hole 82, averaged 1.12 percent nickel and 0.40 percent copper from 358.3 ft. to 381.5 ft. and from 485 ft. to 750 ft. averaged 0.66 percent nickel and 0.26 percent copper. The deeper low-grade zone is a new discovery below what was formerly considered to be the "E" body.

Sherritt Gordon has been awarded the John T. Ryan Regional Safety Trophy for the fourth successive year, emblematic of the lowest accident rate in metal mines of the province.

★ American Smelting & Refining has suspended operations on the Camwe Snow Lake Gold Mines property at Snow Lake.

★ Nesnah Mining & Exploration, Ltd., has completed 3,000 ft. of diamond drilling on claims at Tartan Lake, east of Flin Flon. An ore zone yielding 100 tons per vertical foot grading 0.416 oz. is said to have been indicated.

★ Ogama Rockland Gold Mines, Ltd., at its property in the Long Lake area, has completed slashing the former 117-ft. shaft from two- to three-compartment size and sinking is under way to 525 ft.

★ J. S. McDiarmid, Minister of Mines and Natural Resources, of Manitoba, will be host from Sept. 23 to 25 to the mines ministers of the other provinces, at which time problems of common interest will be considered.

BRITISH COLUMBIA

★ The annual report of the Minister of Mines for British Columbia places the value of 1945 mineral production at $63,343,949, an increase of more than eight million dollars over 1944. In the "metallics" group total value of which was $51,938,493, distribution was as follows: antimony, $292,635; bismuth, $260,047; cadmium, $505,328; copper, $3,244,472; lode gold, $6,751,860; placer gold, $398,591; lead, $17,674,884; mercury, nil; silver, $2,893,934; tin, $484,490; tungsten concentrates, $331; and zinc, $19,431,921.

In the "non-metallics," barites were listed at $63,414; fluxes, $70,266;

granules, $16,272; gypsum products, $127,434; iron oxides, $1,985; sodium carbonate, $3,146; and sulphur $1,267,350. Gross value for the group was $1,549,867.

★The new system of stationing resident mining engineers at strategic locations throughout the Province has been restored. The Hon. R. C. MacDonald, Minister of Mines, announces the following appointments:

Prince Rupert, J. Black and Charles Graham, on part time; Nelson, J. A. Mitchell; Lillooet, J. W. Peck; Cariboo, S. S. Holland, summer work; Vancouver, J. M. Cummings; Fernie, R. B. Bonner and C. Newmarch; Princeton, C. R. Hughes; Kootenay, Dr. M. S. Hedley, summer work; Bridge River, Dr. J. S. Stevenson, summer work; west coast of Vancouver island, H. C. Hughes and W. J. Lynott.

★A committee, consisting of Dr. J. F. Walker, deputy minister of mines, Dr. Hartley Sargent, chief mining engineer, and James Dickson, chief inspector of mines, has recommended that the metalliferous mining industry of British Columbia be exempt from the provisions of the Hours of Work Act, calling for a maximum of 44 hours of work weekly. The committee was of the opinion that any reduction from the present 48-hour week would work a hardship on the industry and could not be successfully applied at the present time. Officials of the International Union of Mine, Mill and Smelter Workers have condemned the report of the committee and have publicly asked for the dismissal from office of its authors.

★Polaris-Taku Mining Co., Ltd., in the Atlin district, resumed milling on July 17 after a suspension of four years. Production was achieved in the face of numerous handicaps, including strikes, insufficient labor supply, and late delivery of essential equipment. About 120 men are now on the payroll, but 200 will be needed to achieve output at present capacity of 300 tons daily. A new crusher, ball mill, and flotation unit are being installed with a view to increasing capacity to 500 tons daily.

★The Zero tunnel of Big Four Silver Mines, Ltd., Portland Canal mining division, is being extended through the Silverado group into Prosperity and Porter Idaho ground. When its objective is reached a raise will be driven to connect with the former workings from which extensive quantities of silver were mined in the previous operation. Recession of a glacier on Mt. Ranney has permitted surface exploration indicating an 800-ft. extension to the Silverado veins. The company has plans for a 200-ton mill to be built in the town of Stewart and connected with the Silverado portal by tram line. E. G. Langille, formerly on the staff of Silbak Premier Mines, Ltd., has been appointed mine manager.

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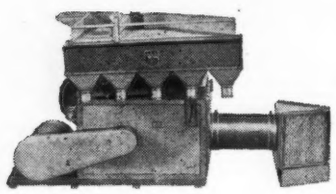

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Canada (*Continued*)

and three shifts at work, advance of the low-level tunnel at the Salmon gold mine of Morris Summit Gold Mines, Ltd., is at a rapid rate. It is proposed to check promising intersections obtained in diamond drilling. A permanent camp is being built.

★Possibly the most important mining deal since the increase in the price of silver stimulated a revival in the silver-producing sections of the Province is that in which Mining Corporation of Canada, Ltd., has acquired the Toric mine, at Alice Arm. The property was extensively developed 20 years ago by Britannia Mining & Smelting Co., Ltd., and large ore reserves containing approximately 20 oz. silver per ton were indicated. Mining Corporation proposes plans to spend more than a million dollars, and to initiate production at a rate of 300 tons daily, within one year. The former Dolly Varden narrow-gage railway will be dismantled and the bed converted into a truck road.

★During the calendar year 1945, Britannia Mining & Smelting Co., Ltd., Howe Sound subsidiary, produced 11,599,650 lb. copper, 7,832 oz. gold, 43,587 oz. silver, and 9,095 dry tons of pyrite after treatment of 566,500 tons of ore. Development work consisted of 2,554 ft. of drifting, 269 ft. of crosscutting, 750 ft. of powder-blasting workings, and 2,506 ft. of sinking.

★Diamond drilling has indicated a 500-ft. extension of the main vein at the Omineca district property of Duthie Mines (1946), Ltd. The road to the mine has been repaired by the Provincial Government. The steam plant has been rehabilitated and reconditioning of the 60-ton mill is now in progress. J. B. McConnell, formerly assistant manager of the Helen mine, in Ontario, has been engaged as mill superintendent.

★The Hangingwall vein in the Jewell north section of the Greenwood property of Dentonia Mines, Ltd., has been intersected by a crosscut about 140 ft. south of the 430 raise. A diamond-drill intersection gave a width of 11 ft. to the vein. The Enterprise 501 south level is being advanced in ore.

YUKON TERRITORY

★July production of the Yukon Consolidated Gold Corporation, Ltd., was valued at $182,000 compared with $153,000 in June. The company has signed an agreement with the International Union of Mine, Mill and Smelter Workers whereby its employees will receive wage increases averaging 18c. per hour. The agreement is for three years, provides two weeks' annual vacation with pay to all men performing a full season's work, and grants a modified "closed shop" clause. G. Goldthorp Hay, of London, England, president of the company, visited the operations last month.

★Registration has been granted Yukon Explorations, Ltd., to issue to Milner, Ross & Co. (for the sum of $620,000 immediate net cash) 999,995 fully paid shares of no par value and $600,000 (par value) of 4½ percent 10-year first-mortgage bonds of the company. The funds will be used for the purchase, development, equipment, and operation of the extensive properties previously owned by Sunshine Mining Co., Idaho lode operator, on Sixtymile River, Big Gold Creek, and Glacier Creek.

The Sunshine Company started to develop the property this season under the management of Church Holmes. A permanent camp is being constructed on Big Gold Creek, about 60 miles from Dawson, which is accessible only to caterpillar tractors and bulldozers. Sunshine initiated operations in 1942 and shipped in a large amount of machinery to Dawson that year, but operations were stopped by the Government ban on gold mining. Sunshine engineers estimated the available placer ground in the different locations would last 20 years.

NORTHWEST TERRITORIES

★It is reliably reported that Consolidated Mining & Smelting Co., Ltd., has let a contract to deepen the shaft at the company's Con property, in the Yellowknife area, from the 13th to the 17th level. At the new depth the shaft would reach to the 2,400-ft. horizon.

MEXICO

Agreement ends menacing strike at dynamite plants — Real del Monte pays silver wage increase

★Industrial circles in Mexico, and particularly those associated with mining, have been greatly disturbed by the course of the recent strike of employees of the two Mexican subsidiaries of the DuPont company: Cia. Mexicana de Explosivos, S.A. 1, and Cia. Mexicana de Mechas para Minas, S.A., in Durango. Trouble began on July 24, when the company turned down a request for a 75 percent wage increase. Following a slow-down that brought production from 900 cases a month down to 60 cases, a strike began on Aug. 9 that developed much bitterness on both sides. On Aug. 23, a settlement had been achieved, but when the company discharged seven of the union's leaders, the men forcibly took over not only the plants of the two companies but the head offices, with all books and records, at Ejido 7, Mexico, D.F., as well. The company appealed to the courts to eject the workers as having violated the Penal Code, and the workers attempted to carry on business as usual, but found few buyers for the dynamite they made. A settlement was reached, however, on Sept. 10, whereby the

workers get a 25 percent wage increase and the discharged men are reinstated. Meanwhile, Mexican mining companies have been hard put to it to secure dynamite. Some bought it in the black market for up to 42 pesos per kilo, instead of the usual 16, and some, such as Fresnillo, came close to a complete shutdown.

★ Cia. Real del Monte y Pachuca is the first mining company reported as having made wage adjustments in line with President Avila Camacho's three-way division of the increase in the price of silver. Real del Monte's 5,000 employees will get a daily pay increase of about 3.50 pesos as their one-third share of the silver windfall.

★ Cia. Minera Santa Maria de la Paz y Anexas reports that the difficulties experienced in recent years in its Matehuala mine, due in the main to insistent wage increase demands under a pegged silver price, too poor rail service between the mine and the smelter at San Luis Potosi, and to fuel shortages, eased noticeably this past year. Transportation improved, the government granted a subsidy on gold and silver production, and though the silver subsidy ended on Sept. 22, the price rose to 70¾c. at the same time. Production increased over that of 1944, exploration and development were satisfactory. Mine output for 1945 totaled 111,361 metric tons from Santa Maria de la Paz, plus 16,032 tons from the La Cruz vein. The ore yielded 37,589.5 tons of concentrate carrying 49,896 kg. of silver, 293.5 kg. of gold, and 2,825 kg. of lead. Net profit after taxes for 1945 reached 546,981 pesos, not including 819,762 pesos set aside for reserve funds. Total capital investment is 3,700,000 pesos.

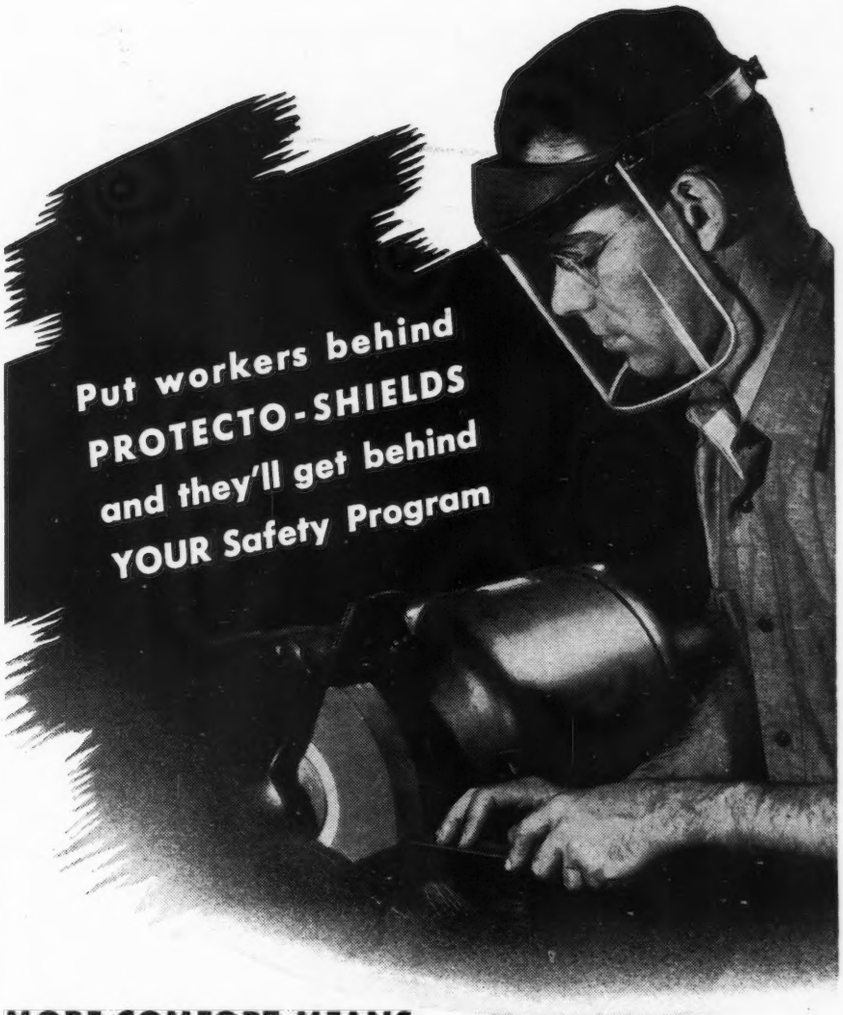
BOLIVIA

Government changes hands in revolution — New tin contract signed with RFC

The following despatch is printed exactly as received from E.&M.J.'s correspondent in Bolivia:

★ After ten years of military governments that managed badly Bolivian economy, in fact worse than at any other time, the revolution of the 21st of July staged against the Villaroel-Paz Estenssoro regime, by the entire population of La Paz, without distinction of political creeds, age, or sex, in an unparalleled feat in the history of modern times, put an end to the two and a half year period of terror and mismanagement in which Bolivia's "dark ages" climaxed.

Salient characteristics of the Villaroel government were its Nazi methods and furiously nationalistic objectives. Only for a few months, and at great risks for whoever dared use it, there was some freedom of press. Taxes



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Bolivia (*Continued*)

and salaries for the mining industry were increased to the point where several mines had to close and only few showed a profit. The contract signed by Aramayo Co. in 1937 to work the Tipuani gold deposits was cancelled. Foreign and local capitals had scant guarantees. As result of its campaign against capital, labor costs increased enormously and efficiency lowered, leaving industry in worse situation than ever, and the workman, as bad off as before. All these were enforced by means of dictatorial powers, assassination, torture, and all kinds of political persecution.

The new civilian government, which counts the backing of all Bolivians, with the exception of the few dozens who are still escaping justice, has a tremendous task ahead. The moral and material reconstruction of the country and the introduction of a true democracy will require considerable effort. But everybody is confident that under the new conditions, and counting on the good will of the friendly nations, Bolivia has started the conquest of a bright future politically and economically.

New Tin Contract

On July 18, 1946, a new contract of purchase and sale of Bolivian tin was signed between the RFC and Bolivian producers, with the exception of Patino Mines Co., which sells its tin, approximately a half of the total Bolivian production, to England.

Realization charges remain the same as in the last contract, but a maximum bonus of 1c. per pound of tin will be paid for the concentrates sold between Jan. 1 and June 30, 1946; and of 3c. on the concentrates sold between July 1 and Dec. 31, 1946, on the basis of a production of 17,611 tons of fine, which has to be exceeded. On the period January to July 1945 the production of the sellers was 13,527.2 metric tons. On the same period for 1946 it was 12,141.2. Although exports have fallen in relation to 1945 it is believed that the terms of the contract for the effect of bonuses will be met.

PHILIPPINES

Work proceeds on new Benguet gold mill — Surigao is first to resume gold production

★ Definite progress is being made in rehabilitation of a few Philippine gold mines in spite of great handicaps in obtaining supplies and equipment from the United States. At Balatoc the tunnel connecting the old haulage level to the new mill site has been completed, and work is being steadily pushed on the 9,000-ft. tunnel that

will reach the Keystone orebody of Benguet. Much work has already been done on the first unit of the new mill, which will ultimately be 4,000 ton capacity. It is expected that the first unit, of 600 to 800 tons, will be ready to operate early in 1947 with ore from Balatoc. A typhoon in July did a great deal of damage in the Baguio District, but roads have been cleared and the destruction has been repaired.

★ Big Wedge property is still waiting for certain replacements to equipment that was damaged or stolen during the occupation. In the meantime work is being carried on for an early reopening when they shall be received. No plans have yet been made for rehabilitation at Itogen or at any of the other Marsman properties, but guards are maintained and salvage work is being done.

★ Surigao Consolidated in Northern Mindanao, has the distinction of being the first gold mine in the Philippines actually to resume production under the aggressive management of J. M. Harrison. Though output is still limited and mining confined to ore that lies close to the surface and is virtually open-cut, at least ore is being milled. Mindanao Mother Lode is also rebuilding as rapidly as possible but is handicapped by delay in receiving machinery from the United States. Rehabilitation in the Masbate and Paracale fields appears to be waiting on payment of war damage claims.

★ At Masinloc, where the huge low-grade chromite deposit of Consolidated Mines is located, active work is going on under the management of Lee E. Blinzler for the Benguet interests. Two substantial shipments of chromite were made some months ago to the United States of ore that had been mined and left near the pier by the Japanese. Regular shipments are anticipated in the early future. Considerable work has been needed to get roads and bridges repaired as well as to build up the native barrio and to get the mine into condition for operation. The Japanese had destroyed all the buildings and equipment and it was necessary to start from scratch.

Much interest is evinced in Philippine chromite and it is reliably reported that engineers representing important American interests are in the Philippines to look the situation over. Chromite claims of promise are being optioned in the Zambales area.

★ Though there is considerable agitation for a free market for sale of gold bullion from the mines, the sentiment for which has been immensely stimulated by the high prices for gold paid currently in Shanghai and the other Far Eastern and North Eastern trading centers, it does not appear too certain that the new republic will consider such proposals favorably. Under the terms of the Bell Act, the Philippine peso is tied definitely to the American dollar, and a free market for gold might cause difficulties in ob-

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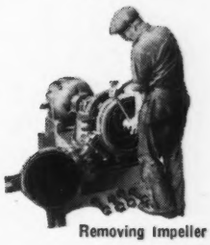
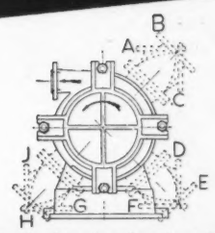
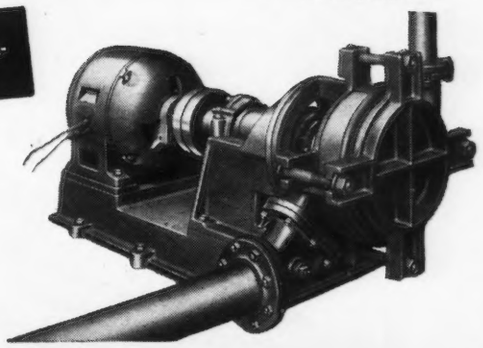


Removing Impeller



Exceptional number of nozzle positions



Developed after 80 years' experience with material handling pumps, this model specifically engineered to handle mixtures containing ore concentrates, tailings, slag, and the residue from filters and classifiers; also all types of caustic or acid mixtures containing abrasives or solids.

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6- Freedom from packing troubles.

7- With clamping effect of bolts on discs, shell is not subject to high stress. Consequently shell can be made from variety of materials with high abrasive resistance though not necessarily of high strength.

8- Shell interchangeable for right or left hand rotation. Suction and discharge nozzles can be rotated around axis of pump to positions in any of four quadrants, a total of 72 possible combinations.

9- Low velocity in suction chamber reduces scouring action, increasing life of chamber which is a replaceable casting not integral with bearing frame.

10- Worn clearances on suction side of impeller easily closed by four adjusting screws.

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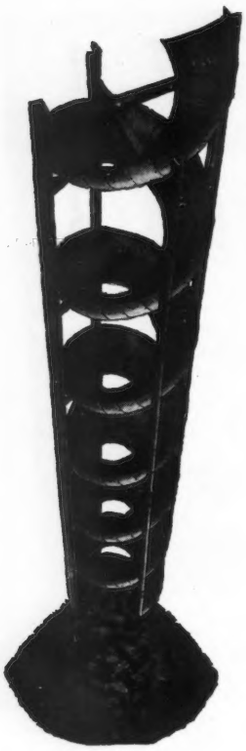

. . . AVOID BREAKAGE

The advantage of Holmes' spiral over previous chutes of this nature lies in the design of the carrying surface, which is formed much as the bowl of a race-track, having no retaining wall on the inside edge. Elimination of this inside edge allows the material to slide gently onto the peak of the pile without droppage. By the same token, the peak of the pile may be carried around the interior of the bin in such a manner that the material is deposited in overlapping layers, where the problem of segregation is present.

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With the advent of scientific consumption of coal and the increased demand for a clean, sized product, much study was given to methods by which so fragile a commodity might be handled into bins and silos without excessive degradation. This problem was solved by using lowering spirals designed to take the material from the conveyor and carry it gently to the bottom of the bin.

Design is such that the lowering speed of the material is automatically retarded when it begins to exceed a safe limit. Regardless of the distance the material travels, its velocity remains uniform; and it reaches the bottom in a continuous, even stream.

Spirals are available with the carrying surface covered to form a spiral tube for lowering above bin enclosure and thus give weather protection.

Coal Bunker Storage

Philippines (*Continued*)

taining exchange. Of course, some scheme might be worked out such as prevails in Mexico or Brazil. With higher costs for labor and supplies, the gold miners feel they are entitled to some such consideration in selling their product.

The speculative excitement in gold mining shares which characterized the Manila market early in the year has tapered off considerably, but prices remained remarkably steady in July and August and have been totally unaffected by the decline in the New York security market. It is believed that with resumption of gold production better prices will be established, for there is an immense amount of faith amongst Philippine investors in the gold resources of their country.

AUSTRALIA

Paringa exploration looks good—Wellington dredge resumes—New Broken Hill output increases

WESTERN AUSTRALIA

★ Paringa Mining & Exploration Co., Ltd., at the northern end of the Golden Mile section of the Kalgoorlie field, has been able to increase production and rate of development. In the last financial year, operations were hampered by war, but during that period, 77,024 long tons of ore was treated, having an average head value of 5.75 dwt. gold per ton, for the recovery of 19,500 oz. of gold, or 87.96 percent of the head value. Mill capacity is 95,000 tons of ore per year, and it is hoped that full capacity will soon be attained.

The mine is shallow, the deepest working level being 640 ft. from surface. Development increased from 2,626 ft. to 3,369 ft., which is still short of the normal progress of 5,000 ft. per annum. Ore reserves are estimated at 124,209 tons of proved ore assaying 5.67 dwt. gold per ton, and 106,471 tons of ore broken in stopes, assaying 4.90 dwt. per ton, a total of 230,680 tons with an average grade of 5.31 dwt. per ton. The company holds several contiguous leases and a group situated about one mile north of the main holdings.

Diamond drilling in the main leases, near the eastern boundry, has disclosed good values. Two completed boreholes gave the following results: No. 62 bore from the 640-ft. level, at 18 ft., 40-in. core, value 7.25 dwt.; at 218 ft., 29-in. core, value 11.91 dwt.; at 345 ft., 96-in. core, value 28.91 dwt. per ton. No. 65 bore, west from the 800-ft. level, gave core of 11 ft. 6 in., which assayed 9.17 dwt. per ton. A series of deep boreholes is to be drilled to explore the eastern ore channels at greater depth.

★Great Boulder Proprietary Gold

Mines, Ltd., is second in importance on the Kalgoorlie gold field. During the company's last financial year, an increased tonnage of ore was mined and milled. Tonnage treated was 306,212 short tons of an average grade of 5.05 dwt. gold per ton, and recovery was 71,563 oz. of gold and 38,774 oz. of silver. Development work totalled 11,322 ft. and underground diamond drilling amounted to 4,825 ft. The total amount of development work in the mine is 64.4 miles and the total diamond drilling carried out is 197,122 ft. Of the year's development work, 2,912 ft., or 25.8 percent., was in ore exceeding a value of 3.2 dwt. per ton.

Ore reserves were estimated at: Positive ore, 1,528,146 tons assaying 5.6 dwt. per ton; 454,857 tons of broken ore, assaying 4.5 dwt.; and probable ore, 409,423 tons assaying 5.0 dwt., making a total reserve of 2,392,426 tons with an average value of 5.3 dwt. per ton. The general mining method is shrinkage stoping, but an increased tonnage is being obtained by cut-and-fill stoping, using classified mill tailings. In the three sections of the mine, 47 lodes are being worked, some of which may correlate with others in different sections. Their width varies from 5½ ft. to 12 ft. The greatest depth is 3,100 ft.

★Prospecting is increasing in activity in the state, and it is possible that an important discovery may be made. The new field at Coolgardie is still prominent, and two encouraging discoveries have been made to the west of the line of country now being explored. Values approximate 15 dwt. gold per ton, and the widths of the lodes so far disclosed are between 6 ft. and 12 ft. The area has been geologically surveyed, and this work has assisted toward the recent discoveries.

★If tests now being carried out by Mount Isa Mines, Ltd., prove satisfactory, a gold-mining plant will be established at Kingston Gold Mine, near Brisbane. Preparations are being made to establish a camp at the mine, which will be worked by open-cut method.

NEW SOUTH WALES

★The dredge of Wellington Alluvials, Ltd., on the Macquarie River, near Wellington, has resumed operations after being idle since the end of 1942, owing to the demand of war on manpower. Since resumption of work, the plant has operated for 11 weeks, or 1,792 hours, of which actual dredging time was 1,224 hours, or 68.3 percent of the total working time. Ground treated amounted to 541,000 cu.yd., of which 298,000 cu.yd was auriferous wash and the remainder overburden. Gold recovered was 1,859 oz., or 1.65 gr. per cubic yard, equivalent to 8.12d per cubic yard dredged. Working costs were 6.99d per cubic yard and may be expected to be in excess of normal costs, due to the various non-recurrent expenses unavoidable in restarting work. The dredge is

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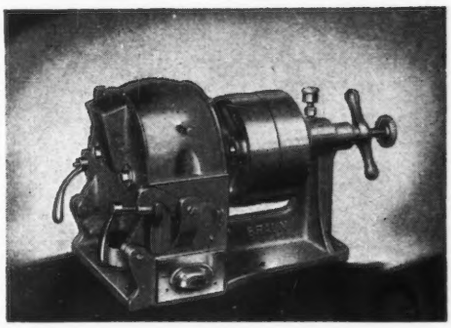

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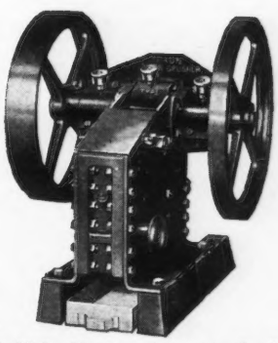

Laboratory sample reduction becomes simple with the Braun Chipmunk Crusher. With a rated capacity of more than 800 pounds of quartz ore per hour, it handles a wide variety of materials swiftly and completely. The Chipmunk, available for either shaft and pulley or direct motor drive with V-belt, is also made in a smaller size with a rated capacity of about 400 pounds of quartz ore per hour.

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Australia *(Continued)*

equipped with 14 cu. ft..-capacity buckets, is electrically driven, and has a monthly capacity of 240,000 cu.yd. The quantity of ground ahead of the dredge is about 50,000,000 cu.yd., with a depth of 65 ft. Resoiling of the tailings is part of the dredging operation, and the reconditioned ground is excellent for argicultural or grazing purposes.

★The mine of New Broken Hill Consolidated, Ltd., at Broken Hill, is gradually increasing output. This property is situated on the south side of Zinc Corporation, Ltd., and covers an extensive area to the southward. The mine has been developed from the main shaft of Zinc Corporation, and ore is being treated at the mill of that company. The mines have a common ventilation system, but plans are progressing for the sinking of a service shaft on the New Broken Hill Consolidated property. At present the mine is producing 1,000 tons of ore per week, the grade being 8.6 percent lead, 15 percent zinc, and 2 oz. silver.

Diamond-drill holes have been put out to test the western lead lode orebodies and indicate the nature of the deposits. One hole disclosed a width of 156 ft. at No. 17 level, assay values being 13.8 percent lead, 2.9 oz silver, and 7.3 percent zinc; a second hole proved a width of 62 ft., with assay values of 9.8 percent lead, 2.3 oz. silver, and 5.2 percent zinc.

AFRICA

American company enters Transvaal mining—Next O.F.S. mine—New lead mine has high potential

★No further details have been published concerning the strike of native miners that interrupted production at eight or more Rand mines during August. On the day the strike ended, Aug. 16, Johannesburg police raided local offices of the Communist party, taking away records for examination. Effect of the strike showed in a decline of revenue for all major mining groups for August, as well as a corresponding drop in gold production. Aggregate profits for August totaled £2,222,350, compared with £2,480,734 for July. Total tonnage milled was 4,775,100 tons, against 4,936,800 tons for July.

★Ladenburg, Thalmann & Co. and Lazard Freres & Co. announced recently that they have formed the American Anglo-Transvaal Corporation, a $20,000,000 company for undertaking mining and industrial activities in the Union of South Africa. Both are New York companies. Operations of the new concern will be managed by Anglo-Transvaal Consolidated Investment Co., Ltd., and Lazard Brothers & Co. and J. Henry

Schroeder & Co., both of London, have been invited to participate in the initial $9,000,000 capital subscription.

★ Rhokana Corporation and Nchanga Consolidated Copper announced recently the formation of a new $10,000,000 copper refinery company, Rhodesia Copper Refineries, which will take over Rhokana's present refinery and will also build and operate a new refinery of about equal capacity. Rhokana's present refinery at Nkana, Northern Rhodesia, has an annual capacity of about 62,000 long tons of copper. When new facilities are completed, capacity will reach 138,500 long tons. Much of this output will come from the Nchanga mine, where an expansion program is under way. The new refinery will handle all the output of both mines, as much as possible electrolytically.

★ The next stage in the opening up of the Orange Free State gold field will probably be exploitation of the African & European Co.'s Block 7, where two or three large mines are contemplated. Control is now in the hands of Anglo-American Corporation. No date for the flotation of a subsidiary to work the area can yet be given, but the time for such announcement must be approaching. Negotiations have been opened with the Mining Leases Board regarding division of Block 7 into suitable mining areas, and Western Holdings, Ltd., has been approached on the question of including in the lease application a small portion of that company's northern area, which is separated from the rest of Western Holdings' ground by a major fault.

★ Out of 42 boreholes put down in the Block 7 ground up to April 30, 28 intersected Leader reef, of which two gave payable values averaging 4.4 dwt. over 46.8 in. In the Basal Reef, 32 boreholes were drilled, of which 16 gave payable values averaging 25.6 dwt. over 17.1 in. No further drilling of the company's reef-bearing area of 5,000 morgen is believed necessary except that for incidental to shaft sinking, which could therefore begin at once. In the company's adjoining Block 8, no important results have been reported, but geophysical work is being carried on to determine if further drilling is justified there.

Mining Congress Meeting

(*Continued from page* 84)

quantity of quicksilver, obtained by conquest, to a domestic broker at only $36 per flask. He said that a six-year supply of developed ore, largest in many years, will probably be placed in jeopardy by present policies. Burwell declared that the tariff had fostered domestic tungsten productivity and "know-how." He indorsed stockpiling tungsten from foreign sources but recommended continued tariff protection to foster deep mining as a precaution against the time when tungsten would no longer be available from shallow workings. Speaking on

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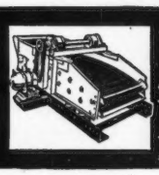

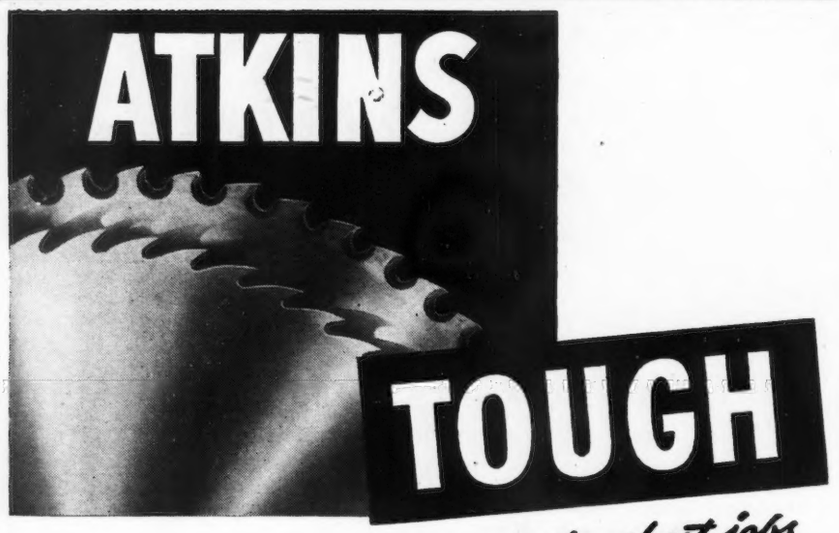

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Mining Congress (*Continued*)

antimony, Bradley stressed the accomplishments of domestic producers, and urged a higher antimony tariff to encourage development of our substantial low-grade domestic reserves.

Discussing "Ore Reserves and Future Exploration," Reno H. Sales, Anaconda Copper Mining Co., said that we are confronted with a serious situation in copper, lead, and zinc, calling for action in finding new orebodies. He directed attention to the anti-conservational effect of low and fluctuating metal prices, the desirability of encouraging small-mine development, and the potential importance of undiscovered ore in areas of established productivity. He said that large areas in the mountainous West probably do not possess accessible mineralization, and he particularly recommended attention to sediments as likely areas for prospecting. Stressing the consumer's stake in continued productivity, he emphasized the need for equitable tax policies and modification of the mining code to meet modern prospecting conditions.

Mapping Program Needed

Richard N. Hunt, U. S. Smelting, Refining & Mining Co., discussing "How the U. S. Geological Survey May Serve the Mining Industry," urged that the Survey should devote itself particularly to an expanded mapping program in regions surrounding economic deposits and in new areas; also to fundamental research, particularly on weathered outcrops and in geophysical prospecting.

Describing the "Role of the Geological Survey in Mineral Exploration," Dr. William E. Wrather, Director of the Survey, delineated the nation's stake in knowledge of reserves and in a healthy reserve situation. He said the Survey should leave off where industry begins and emphasize mapping, appraisal of reserves, development of submarginal deposits, and fundamental research. He asked for criticism of, and support for, Survey activities.

Speaking on "Canadian Treatment of Mining Ventures," Ira Joralemon, San Francisco consulting engineer, described Canada's high rate of discovery, its more liberal and practical treatment of security flotation, and the several ways in which Canadian tax laws encourage enterprise and development.

Dr. Louis B. Slichter, professor of geophysics at the University of Wisconsin, gave a detailed account of the "Current Status and Potentialities of Geophysical Prospecting," recommending more research to perfect methods and emphasis on electrical and seismic methods.

Discussing "Public Land Policies in Relation to Mining," Joel D. Wolfsohn, Bureau of Land Management, called for support of federal recording of claims to prevent confusion, the patenting of more claims, suppression of fraudulent claims, and

reconciliation of the claim system with atomic energy resource problems. He defended the land withdrawal policies of the Interior Department. These policies were then denounced as sneaky and dishonest by Burt B. Brewster, mining editor, of Salt Lake City.

W. C. Broadgate, technical consultant to the Senate Small Business Committee, described the problems of working out a satisfactory bill for geophysical mining claims, and outlined the provisions of the latest draft revised after extensive industry consultation. Commenting, Robert Longyear, of Minneapolis, urged adequate room in claims for drilling and geophysical work, allowance of discovery by drilling, and admission of drilling and geophysical and geological work as assessment work.

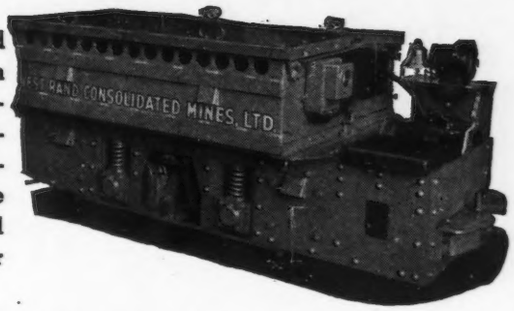
Leo J. Hoban, treasurer of Hecla Mining Co., discussed "Stockholders as a Public Relations Medium." He described the trend toward more informational reports and simplified accounting, but characterized as doubtful the effectiveness of inducing stockholders to strive to secure legislative objectives. Discussing this paper, Tom Lyon, International Smelting & Refining Co., maintained that stockholders may be helpful in influencing legislation and urged the establishment of a central agency to disseminate useful information to stockholders in mining enterprises.

Krug Offers Cooperation

The feature speaker of the convention was J. A. Krug, Secretary of the Interior, who emphasized in unequivocal terms his espousal of democratic principles and free private enterprise. He called attention to the problems of future mineral supply and advocated maintenance of healthy, going domestic mineral industries, but was against "Buy American" provisions beyond attainment of this objective. He espoused Government aid in developing submarginal deposits and the withdrawal of Government from areas in which private enterprise can function efficiently. He offered full cooperation with the mining industry and requested that an industry committee be appointed to advise him on mineral problems.

At the first technical session G. T. Harley, manager of International Minerals & Chemical Corporation, described the extensive use of mechanical equipment in potash mining. Coalmining equipment such as cutting machines, loaders, auger drills, and shuttle cars have been adapted with success in mining operations, he said. Joy loaders are used "in reverse" to backfill rooms underground, and bulldozers are used to clean up headings.

L. E. Young, consulting engineer, observed in the ensuing discussion that achievements in mechanical research were due largely to the cooperative effort of mining engineers and factory representatives, and that continued work was necessary on



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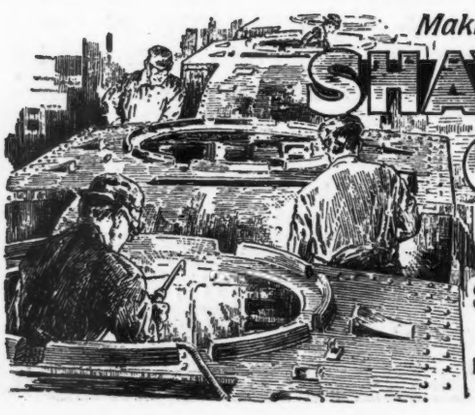

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Mining Congress (*continued*)

waste handling, ventilation, fragmentation of ore, and ore transportation.

George M. Grismer, superintendent of the Polaris Mining Co., Wallace, Idaho, described the operation of Riddell clamshell shaft mucker, which enables shaft crews to load 30-cu. ft. buckets in 1½ to 2 minutes. The Polaris company set a record in the Coeur d'Alene district by completing 183.75 ft. of timbered shaft in one month with this equipment. J. Murray Riddell, of the Michigan College of Mining and Technology, who developed the mucker, stated that seven other shafts had been mucked with this equipment. The largest was 12 ft. 6 in. by 21 ft. 4 in. Inclined shafts as steep as 25 deg. can be mucked with mechanical mucking machines, in the opinion of Cecil A. Fitch, assistant general manager, Chief Consolidated Mining Co., Eureka, Utah. Eimco-Finlay 12B muckers were adapted to sinking operations at the Apex Standard property by adding greater weight to the rear of the machine for balance and improved traction on the rails. A cable snubbing device which travels around special drums on the front wheels permits positive control of the machine motion.

As a result of six years of experimental work with shaker conveyors at Ray Mines division of the Kennecott Copper Corporation, Robert W. Thomas, general manager, concluded that such conveyors have a definite place in block-caving mines. Ray Mines will experiment with shakers which will discharge onto a cross-belt conveyor in the future. Jack Still, mine superintendent, Miami Copper Co., said that operating data involving the moving of 1¼ million tons of ore with scrapers and 2½ million tons with shaker conveyors did not reveal conclusively which method was best in the final analysis.

Underground Diesel Haulage

S. S. Clarke, general superintendent of mines, Eagle-Picher Mining & Smelting Co., reported that the use of diesel trucks for underground haulage had resulted in no harmful gases, basing the conclusion on the thorough hospital examinations of men who were exposed to the haulage atmosphere. He praised the U. S. Bureau of Mines for its cooperation in making initial tests. Oscar Johnson, president of the Mine, Mill & Smelter Supply Co., read a paper by C. W. Plumb, general manager of the Idarado Mining Co., which summarized the successful and economical operation of diesel locomotives at that property.

W. T. Warren, general superintendent, National Tunnel & Mines Co., illustrated with slides the manner in which diamond-drill blast-hole methods may be applied to stopes with considerable variation in w.dth and

dip, and described a method of "sinking" a raise by using a large central diamond-drill hole surrounded by smaller holes. He produced metal containers for shaped charges, one of which was fashioned from a boarding-house peach can. Tons per man-shift have been increased 30 percent as a result of using the shaped charge for secondary blasting. Discussion of recent developments and drilling and blasting practice was led by E. R. Borcherdt, research engineer, Anaconda Copper Mining Co.

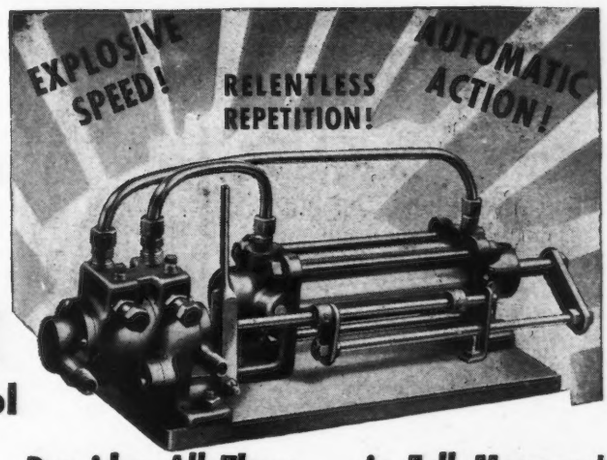
Safer, faster, and more flexible shaft operations have resulted from the installation of the two-way, carrier-current communication system at the Homestake mine, which was described by C. N. Kravig, assistant mine superintendent, and Rex Tario, electrical engineer. Vocal signals instead of code signals are used because it was found that lightning can produce false code signals. Cagers give landing chair instructions en route and can alter instructions for cage stops while in motion. Red and green lights in the hoist room indicate off and on positions of landing chairs.

B. R. Coil, general superintendent, Miami Copper Co., said that three years' experience with truck haulage at Castle Dome had demonstrated the satisfactory value of the equipment. He concluded that one standby unit should be provided for every two or three trucks in use and that operators and mechanics must be experienced and trained.

Milling Progress Reviewed

New developments in milling reviewed by S. R. Zimmerley, chief of the Salt Lake Division, Metallurgical Branch, U. S. Bureau of Mines, included a discussion of the following methods of concentrating low-grade ores: heavy media (sink-float), Humphreys spiral, selective media concentration, and concentration by hydraulic classification. A number of successful installations of automatic controls for grinding and classification were described. Processes were also described in which flotation pulps are heated to 250 to 500 deg. C. to produce superficial oxidation of certain sulphides. This method is useful for the treatment of bulk concentrates which do not respond to orthodox methods of flotation. The dithionate process which uses waste SO_2 gases from smelters to leach manganese and other metals from ores was also discussed. The process shows considerable promise for the treatment of off-grade marmatitic ores.

A carbon-cyanide process whereby gold is adsorbed from cyanide solutions by the introduction of activated carbon in the ball mill or classifier overflow, or by confining it in a screen during dissolution and adsorption, was described by R. A. Hardy, consulting engineer, Getchell Mine, Inc. J. G. Chapman, of the University of Arizona, F. W. McQuiston, metallurgist for Newmont Mining Corpora-



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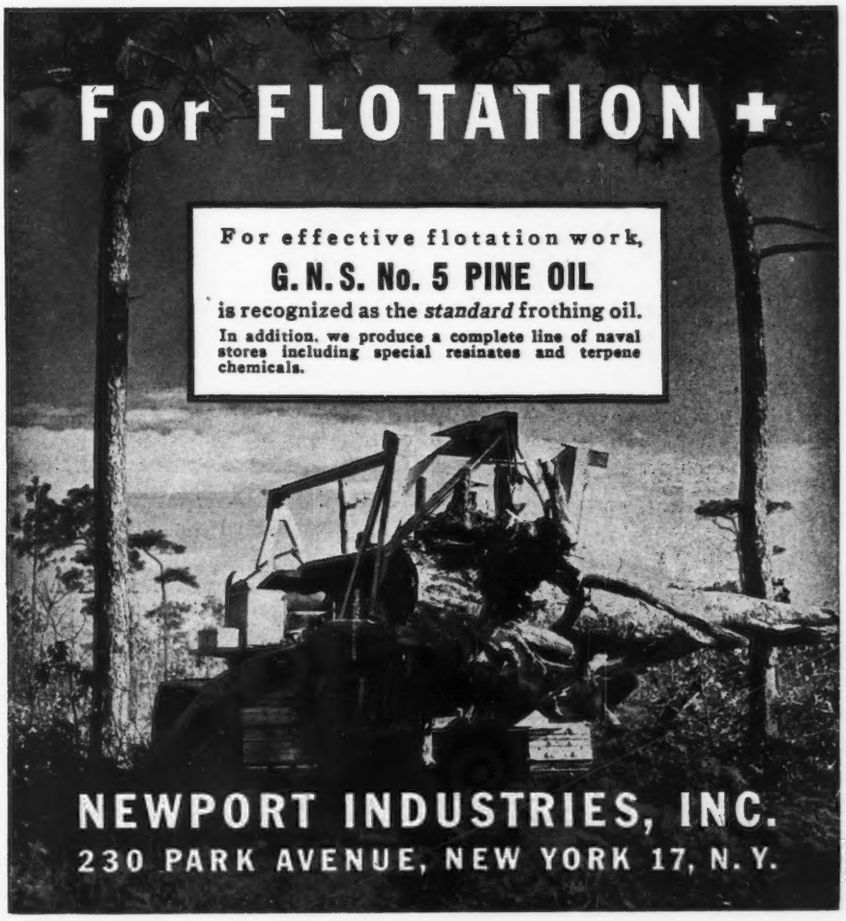
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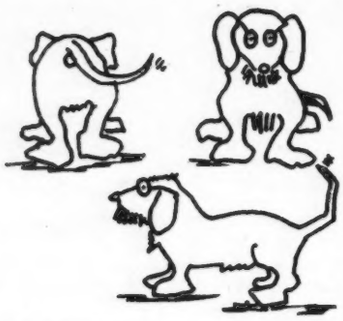

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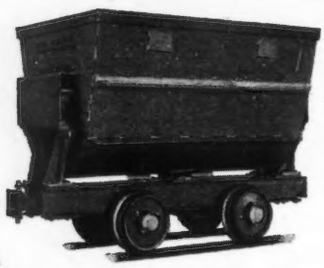

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Mining Congress (*Continued*)

tion, and J. N. Davis participated in the development of the process. Mill tests indicate that this method will simplify metallurgical treatment and plant flowsheets considerably.

A. H. Zeilinger, safety engineer, Colorado Fuel & Iron Corporation, analyzed causes of industrial accidents, and presented estimates that approximately 88 percent of accidents are due to faulty human behavior and 10 percent to lack of adequate safeguards, and thereby indicated where the greatest area for improvement lies. W. E. Jones, of Climax Molybdenum Co., read a paper for Dan Herrington, Health and Safety Branch, U.S.B.M., which decried the fact that trainees for first-air courses had fallen from a yearly average of about 81,000 in the 1927-37 period to about 15,000 in recent years.

James Richardson, of the Utah Metal Mine Operators Association, urged large operators, who are generally sold on safety, to encourage and assist small-mine operators to establish improved safety systems, lest a few violations lead to unfavorable publicity, resulting in a national safety code for metal mines which might work hardship on large and small operators alike.

AMC members and guests were welcomed at a luncheon on Sept. 9 by Ben F. Stapleton, Mayor of Denver, and John C. Vivian, Governor of Colorado. Merrill E. Shoup, chairman of the Western Division, presided; and Howard I. Young, president of the congress; J. B. Hoffner, chairman of the program committee; and R. H. Pearson, chairman of the manufacturers division, joined in the responses. Edwin C. Johnson, U. S. Senator from Colorado, greeted the members, and then related the experiences in the early development of the atom bomb, which he acquired as a member of the Senate Committee in charge of that work. He emphasized its potential devastating power directing the attention of those present to the known fact that bombs can now be developed which are 1,000 times as effective as the bomb used at Hiroshima.

Policy Declaration

(*Continued from page* 84)

are based on a preponderance of relavant evidence. A law should be enacted to protect an employee from being required to join or remain a member of a union as a condition of employment.

Employers should be forbidden to pay money as royalties or otherwise to unions save as authorized payroll deductions.

Supervisory, professional, and administrative employees should be declared exempt from the provisions of the National Labor Relations Act.

Union proposals encroaching on the employer's right to manage his busi-

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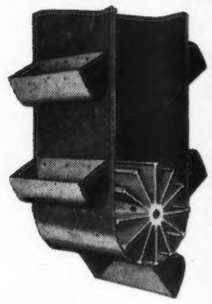

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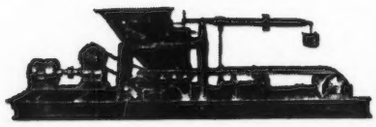

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ness should be legally excluded as subjects for collective bargaining.

Working time should be time actually worked. Court interpretation of work-time under the Fair Labor Standards Act should be corrected. Time for bringing civil suits to collect damages and penalties arising under this and other Federal laws should be limited to a year.

The Mining Congress also declared that it should be unlawful for a union to spend money in behalf of a candidate in any election or other political activity.

Price Control

Immediate decontrol of metals and minerals and return to a free market were urged by the Mining Congress. Pending this, it advocated that prices of non-ferrous metals should be raised to parity with the corresponding prices on world markets and kept there.

Tariff

Adequate tariff policies must be maintained to protect domestic mining against competition of richer deposits, lower labor costs, exchange regulations, and foreign cartels. Where considerations of national defense and the national economy require production over that available under free market conditions and tariff policies, certain mineralized areas from which substantial production is available should receive special assistance.

Stockpiles

The Mining Congress indorsed the recently enacted stockpiling legislation and pledged cooperation to the Army and Navy Munitions Board in administering the act.

Public Land Policy

Opposition was expressed by the Mining Congress to nationalizing the country's mines, or to extending the Government leasing system to cover lands valuable for metals and minerals long subject to laws authorizing location and patenting of claims. It likewise opposed expansion of the leasing system by executive order under which (a) seizure or sale for federal use or distribution of any part of production from leased lands over and above royalties in kind would be authorized; or (b) private exploration for minerals subject to leasing would be prohibited or restricted.

Amendment of statutes governing creation and extension of Indian reservations on the public lands, including Alaska, to require that federal mining laws be continued in force on land thereafter reserved, was advocated; also, immediate review by Congress of reservations created by executive order in the past ten years, followed by legislation reducing their areas to the needs of the Indians therein and restoring to exploration previously eliminated territory. It was urged also that all military reservations not needed for defense be returned to the domain and reopened to exploration. The pending bill reestablishing Congressional control over public-land withdrawals was indorsed.

Discontinuance of the policy of the Land Office in refusing applications for patents in mining regions was urged by the Mining Congress, as well as of requirements as to demonstrated mineral values prior to full development of the properties where no reasonable doubt of this value can exist. Return to the former policy of granting patents liberally was advocated.

Legislation was advocated to permit miners in Alaska to mine the beds and banks of navigable streams subject to the public right of navigation.

Abandonment to the coastal states of title to lands below the high-water mark and to their mineral content was favored and legislation asked in order that the states' traditionally recognized right to these minerals may be established. The Mining Congress, however, opposes the proposal made in Congress that the entire public domain be ceded to the respective states in which it is located.

Resoiling Dredged Lands

Recent legislation enacted in local communities of California to compel resoiling of dredged lands was disapproved by the Congress as being physically impracticable and economically unsound.

Primary Mine Financing

Complaining about the present federal and state restrictions on the financing of primary mining ventures, the Mining Congress recommended a reorganization of the division of the Securities Exchange Commission so that at least the men making final decisions in that department may be experienced in the problems of prospecting for, developing, and financing of such ventures. It further urged that the SEC laws be amended so that only the fraud sections of the present Federal laws be applicable in selling primary mining securities and that the various state laws go no further than that in their requirements.

Valley Authorities

Legislation vesting control over water pollution in a federal agency was opposed by the Congress because this problem is strictly a local one. The Congress also expressed opposition to the so-called Valley Authorities program, stating that the development of our waterways and reclamation of arid lands can best be carried out through existing federal, state, and local agencies cooperating with private industry. The group particularly objected to the assumption of control over all natural resources by such authorities.

Orderly development of waterways under the direction of Army engineers and the Bureau of Reclamation was favored, provided such projects are deferred so as not to drain sorely

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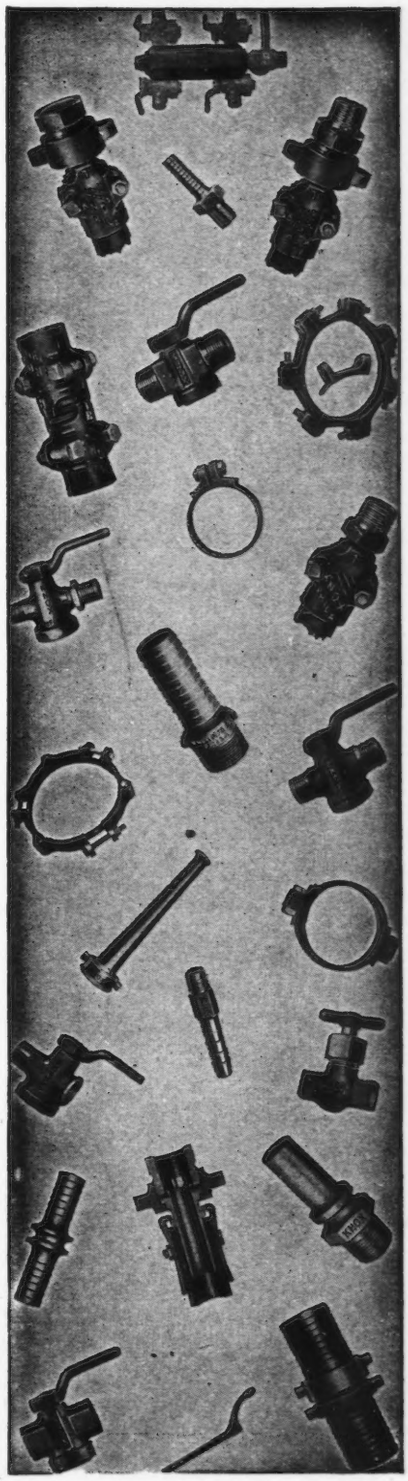

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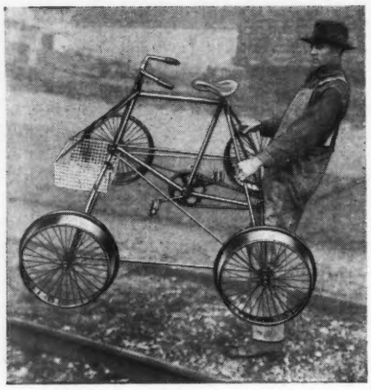

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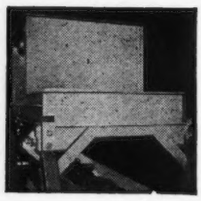

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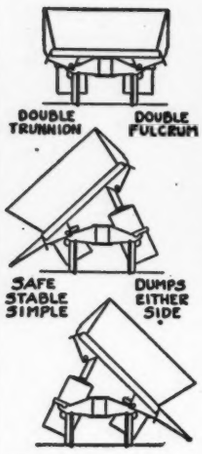

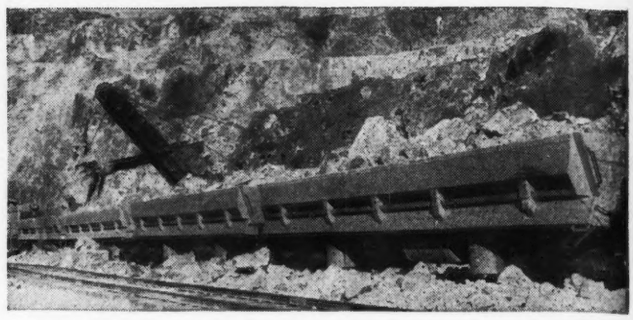

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Policy Declaration (*Continued*)

needed manpower, materials and equipment from essential industry.

The St. Lawrence deep waterway and power project was opposed because it would impose large tax burdens, be of principal benefit to foreign shipping and products, and would disrupt great mining, metallurgical, and other industries on the Great Lakes basin which are vital to the nation's welfare.

Gold Mining

Legislation was urged by the Congress to reimburse owners or operators of lode or placer gold mines for capital losses and unreimbursed costs resulting from enforcement of WPB Order L-208. It was recommended that gold-mine owners be granted the right to export newly produced gold and sell it in foreign markets.

The Congress favored a currency with the traditional base of gold and silver, and anticipates stabilized prices of these metals at levels that reflect their true world values.

Taxation

Prompt revision of the federal tax system was urged, to avoid drying up revenues at the source and to allow adequate incentive for investment and employment. There should be an endeavor, the Congress maintained, to have law and regulations which can be reasonably understood by taxpayers; and the administration of the law "should not be distorted by hypertechnical interpretations which nullify or reduce the depletion and other deduction Congress intended to grant."

Taxable income should be brought to the standard of net income as ordinarily understood with time and nature of accruals conforming as nearly as practicable to good accounting practice.

It was contended that features of the tax law should be revised as follows:

Corporate income tax rates and the higher individual surtax rates should be reduced to a point at which they will not, as at present, exceed the point of maximum productivity. Dividends should be taxed to individuals only to the extent that the individual's tax rate on the earnings involved exceeds the corporate tax rate. Intercorporate dividends should not be taxed. Individual income should in no event be subjected to an over-all tax rate exceeding 50 percent.

In determining taxable gain, full allowance must be made for capital recovery. Losses of loss years should be fully deductible in determining the income of years subjected to tax. Carry-back and carry-forward losses should be computed in a manner which will eliminate discrimination. Taxpayers having loss years interspersed with profitable years should not be subjected to heavier tax burdens than those having similar aggregate income evenly distributed over the same period without years of loss. Particularly, there should be no discrimination against percentage and discovery depletion allowances. The taxpayer should be given every reasonable latitude as to amount and method of computing reasonable allowances for depletion and depreciation, and the tax benefit principle should be applied so that amounts will be considered as theretofore allowed only to the extent they resulted in a tax benefit to the taxpayer, or allowable to the extent they might have given a tax benefit. Costs of development, exploration, and research should be allowed as part of the operating expenses of mines.

In regard to the repealed excess profits tax, the Congress stated that relief provisions of Section 782 have become of doubtful effectiveness. Confidence was expressed that the newly created advisory council will administer provisions in accordance with the intent of Congress to give merited relief.

Repeal of the excise tax on freight, which was adopted as a war measure, was recommended. Congress was commended for adopting a procedure in the Congressional Reorganization Act which provides that body with an effective control over expenditures.

In a concluding resolution the Mining Congress opposed Government controls and rule by bureaucracy, and reaffirmed its belief in a system of free, private, competitive enterprise.